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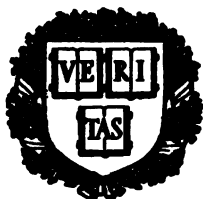
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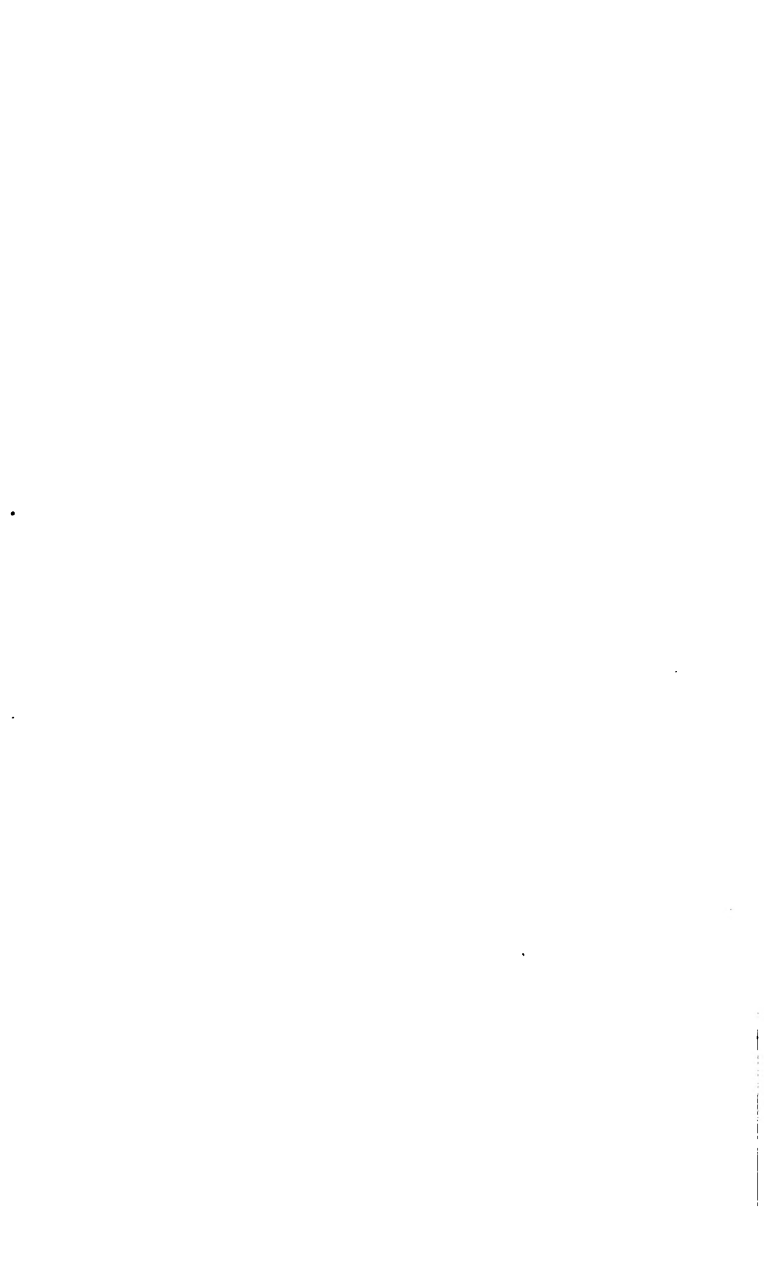
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THE

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THE

SOUL IN NATURE,

WITH

SUPPLEMENTARY CONTRIBUTIONS.

BY

HANS CHRISTIAN OERSTED.

TRANSLATED FROM THE GERMAN

BY LEONORA AND JOANNA B. HORNER.

LONDON:

HENRY G. BOHN, YORK STREET, COVENT GARDEN.

1852. //

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TO MATHILDE OERSTED.

WE dedicate this translation to you, as a slight token of our friendship, and of our lively recollection of your highly gifted father, whose various philosophical researches you followed with such deep interest. We sincerely hope that we may, in some degree, have fulfilled your father's earnest wish, that a true representation of his views of Nature should be presented to the English Public.

L. & J. B. HORNER.

January, 1852.

THE LIFE OF H. C. OERSTED.

By Peter Ludwig Simon

IN the north of Europe, and especially in Denmark, there appeared at the end of the last century a number of distinguished men, among whom we may mention the names of Oehlenschläger, Thorwaldsen, the Swede Berzelius, the Norwegian Steffens, Rask, the greatest philologist of modern times, who died so prematurely, the philosopher Sibbern, and the two brothers Oersted. The younger brother still lives, and is the most eminent and acute jurist of the north; by his ardent and intellectual study of Kant and Fichte when still a youth, he gained for himself in the meridian of life a distinguished reputation in Germany. The eldest was the physicist, whom we will now consider from a somewhat nearer point of view.

Hans Christian Oersted, the subject of our present memoir, was born in the year 1777, in the little town of Rudkjøbing, on the Island of Langeland. His brother was also born there in the following year. Their father was an apothecary, and in narrow circumstances; he had, therefore, but little to spare for the education of his children, even if the small town in which they lived had not been almost entirely deficient in means of instruction. The young Oersteds, however, learned to speak and to understand German from a native of Germany, who lived in their neighbourhood. The eldest taught himself arithmetic from an old school-book, and immediately imparted his newly-acquired knowledge to his brother. Thus the two boys, eager to gain information, passed several years under their parents' roof, educating themselves

by mutual instruction and communication. At a later period they acquired Latin from the lessons of a private tutor, but Hans Christian, in his twelfth year, was taken into the shop as an assistant to his father, where he soon took the greatest pleasure in the chemical part of his employment; at the same time, however, eagerly devouring all the warlike and historical books which fell into his hands in this retired spot.

The brothers soon discovered that, supported by the happy talents with which nature had endowed them, and by the constant exchange of the knowledge they had separately acquired, they might, with a little additional assistance, pass the examination in such a manner as to enable them to enter the University of Copenhagen; and in this they were successful. In 1794 they went to Copenhagen, where they were at first, indeed, obliged to live very sparingly; but they desired nothing better than to bury themselves in their studies, and they passed the two first examinations with the happiest results. They received some assistance from the Government, and supplied what was deficient by private lessons; but at this point their mental paths divided. Almost forgetful of the surrounding world, and following inclinations which had manifested themselves at an early period of life, the younger brother immersed himself in philosophy and law; the elder in astronomy, physics, and medicine. They still continued, however, to live together, and to impart to each other the results of their different studies, but they entered very little into general society. Rarely had the University beheld two students who, scarcely recognizing or appreciating the pleasures of the exciting days of youth, resigned themselves with such eagerness and delight to an earnest life of study.

Oehlenschläger, whose sister at a later period became the wife of the younger Oersted, was almost the only friend of

the two brothers. He was several years their junior, and formed a most decided contrast in character by his eager excitability, and the exulting pride of youth. This friendship of the youthful trefoil was maintained in undiminished intensity and freshness to the very last, when the two brothers, who from early youth had most intimately and actively participated in the brilliant development of the celebrated poet, accompanied him to his last home. But it was the youthful days of those three young men which presented an amount of talent and mutual emulation, and one common onward striving, such as is rarely to be met with in history. It is well known, and it may be considered as a favourable circumstance, that the period of their youth happened during the greatest mental fermentation which has been exhibited in modern times. A new era of politics commenced in France, and of philosophy and poetry in Germany; mental life was everywhere in action. Steffens returned to Denmark from Germany with a complete series of intellectual lectures, and stood forth as the proclaimer of the new philosophical and poetic Gospels, and the minds of the three young Danes rapidly and powerfully matured under the universal European spring sun. Hans Christian Oersted, *ex-officio* a physician, but by inclination a natural philosopher, became attached to the new æsthetic tendency, which especially prevailed in the north, and in 1797 he gained the University prize (a gold medal) by a reply to the æsthetic prize question, "On the limits of Poetry and Prose." About the same time he passed his pharmaceutical examination, and in the following year he gained another prize, by a medical prize essay. In 1799 he wrote a dissertation for his doctor's degree on "the Architectonicks of Natural Metaphysics," and by it proved that not alone had he investigated with clearness and originality the actual matter of his own particular sciences, physics and chemistry; but that he had

embraced the whole with a universal and philosophical perception, independent of certain prevailing systems. In the metaphysics of nature, he had emancipated himself in some essential points from Kant; and in a criticism of Gadolin's *Introduction to Chemistry*, he exhibited a new theory of alkalis, which at a later period was universally adopted. He now (1800) undertook the charge of an apothecary's shop, and delivered lectures on chemistry and natural metaphysics.

In the same year the galvanic battery was discovered by the Italian Volta, and galvanism now appeared as one of the most powerful forces of nature, which everywhere invited the disciples of science to new experiments. Oersted also took an active part in it, and even his first experiments led to new discoveries with respect to the powerful action of acids during the production of galvanic electricity, and of the relation of the opposite effects developed through the conductor of the battery to both poles; while he proved that both acids and alkalis are produced in proportion as they mutually neutralize each other.

Inspired with an earnest desire to penetrate deeper into the world of knowledge, he set out in 1801 upon his first journey into a foreign country, and there never was a more exciting or fertile period for an ardent spirit. Brown had changed the school of medicine into a battle-field, and the Hungarian chemist Winterl had given forth a new system in his eminent work, *Prohusiones*, which was reserved for the young Dane to bring forward by means of a critique to the German public, by whom it had at first been little regarded. Oersted at that time became personally acquainted with the celebrated men of Germany, and he everywhere met with the most favourable reception: the unusual depth of his learning and his active mind astonished all who came in contact with him; and the youthful freshness of his almost childlike

external demeanour won all hearts. Amidst the number of distinguished men with whom he had intercourse in Germany, we may especially mention Schelling, the two brothers Schlegel, Fichte, Schleiermacher, Tieck, Z. Werner, Fr. Baader, Erman, Kielmeier, Rumford, and the mineralogists Hausmann and Weiss. But he became most intimately acquainted with the celebrated physicist Ritter, who was then at the height of his fame. At a later period, Oersted had an opportunity of doing him a great service. In the winter of 1802-1803, he spent some time in Paris, where he diligently studied and mastered the French language and literature; and it was just at that period that Ritter, having discovered his "Pile" (Ladungssäule), sent a treatise of it to Oersted, written in his peculiarly obscure style, with the request that he would translate it into French, that it might compete for the annual prize of the French Institute. The latter agreed to the proposal, and performed the task so well, that Ritter afterwards asserted "that he understood the translation better than his own writing," so thoroughly had Oersted's pliable mind previously familiarized itself with the thoughts and method of the German physicist. The merits of the discovery were not, indeed, at that time appreciated by the Institute, but they were more fully recognized at a later period.

Oersted returned from Paris (1803) by the route of Brussels, Leyden, Haarlem, and Amsterdam. At home he continued to be considered more in the light of a natural philosopher, and less as a physicist, and on that account he was unable to obtain the chair of physics, though it was then vacant; however, for the period of three years he received an income of 300 bankthalers from the public purse, and an equal sum for experimental purposes. The University had at that time lost by fire all the instruments belonging to the laboratory, and those used for the purposes of natural philosophy; but

he fortunately received a private collection of instruments, by means of which he delivered lectures before a numerous and educated audience on electricity, galvanism, and magnetism, heat, light, and combustion, in accordance, indeed, with the dynamic theory, which deduces all chemical effects from the same fundamental forces. At the same time, he published numerous German and Danish treatises, the most important of which were *The Series of Acids and Bases* (in Gehlen's *Journal*), and especially his *Observations on the History of Chemistry*, which is most intimately connected with his scientific career, and is remarkable for pointing out the development and general tendency of his mind.

Ørsted's intellectual and deeply-interesting lectures, but especially the publication of his new experiments on the acoustic figures,* at length paved the way in 1806 for his obtaining the professorship of physics at the University of Copenhagen. His active nature was now fully occupied by numerous public and private lectures; he succeeded in considerably enlarging his collection of instruments, and he was indefatigable in making experiments; he became teacher at the Academy of Land Cadets; he delivered lectures for the adjutants of the general staff, and in 1809 he published his *Manual of Mechanical Physics*, which was considerably enlarged and altered in 1844. The appearance of the portion devoted to chemistry was delayed partly by his travels, partly by the annual advances of science. During this ardent and ever enthusiastic activity in his own science, which was constantly developing itself, he refreshed himself in his private life by intercourse with an intellectual and stirring circle of society, which included the first men of his time, among whom were his brother, Steffens, Oehlenschläger, and the witty poet and critic Baggesen, who was his opponent at a later period. By intercourse with these men he was kept in

* See the Dialogue on Tones, in the following pages.

lively communication with the philosophical and æsthetic excitements of the period. Fichte also, who in 1807 spent some time in Copenhagen in search of repose, formed one of this circle.

Ørsted undertook another journey to Germany and France in 1812 and 1813. He remained a considerable time in Berlin, and, urged by Niebuhr, he there published his *Vices of the Chemical Laws of Nature*, which in Paris he translated into French.* We perceive by the title of the French work how his thoughts were already fixed in that one direction in which he was soon to make his name famous to the world by a great discovery, whose results are already proved to be of universal value. We need only here allude to the electromagnetic telegraph, which probably without Ørsted would not yet have existed.

On his return to Denmark in 1814 he married; by which marriage he had three sons and four daughters. His active participation in intellectual life involved him in a keen literary dispute with Grundtvig, in which he asserted with enthusiasm his conviction of the harmony of Reason with the law of Nature, and of the unfettered power of the judgment, in opposition to the ultramontane paradox of that author, who in an otherwise intellectual "world-chronicle" (*welt-chronick*), chose to employ the Bible, even in its most literal interpretation, as the exclusive standard of final decision on historical characters and events. In a university programme also for the year 1814 on "the technical language of the Gothic and German tongues employed in chemistry," Ørsted published a series of ingenious hints in favour of a national scientific terminology emancipated from the Greek and French terminology hitherto employed, which has already for the most part become popular; and in a speech at a festival (perhaps with allusion to the orthodox Grundtvig), he repre-

* *Recherches sur l'identité des forces électriques et chimiques.*

sented the practice of science to be a religious worship. Most of his time was besides occupied with lectures, which during several winters he delivered daily for five hours; some of these were in German, for the *corps diplomatique*. He introduced a monthly lecture, which he continued to the last, in which he gradually communicated and explained all the discoveries of the day on experimental Natural Science; he also about this time discovered a galvanic copper-cell apparatus (*kupferkasten apparat*), together with a new method to blast mines. In 1818 and 1819, by command of the king, he examined the Island of Bornholm, accompanied by the distinguished geologist Forchhammer of Holstein. This island had been hitherto neglected, but was mineralogically interesting, and rich in ironstone and coal.

At length came the year 1820, from which may be dated Oersted's great fame, and called by himself the happiest year of his life. He discovered "*electro-magnetism*," or *the law of reciprocity between electrified bodies and the magnet*. The actual discovery of this hitherto unknown law of nature, which already, in the few years that have since elapsed, has produced such extraordinary effects, was developed during a course of lectures *a privatissimum*, which in the winter of 1819 and 1820 was delivered before some of the *proveciores* (the more advanced students). The original idea, however, whose real existence now for the first time became a fact, he had carried in his mind for a long period, and even in the year 1813, in the above-mentioned work, *Views of Chemical Laws of Nature*, he had expressed his anticipation of the existence of a near connection between electric, galvanic, and magnetic currents. If galvanism, he thought, be only a hidden form of electricity, then magnetism can also be only electricity in a still more hidden form; and his efforts were directed to the inquiry whether electricity in a galvanic form might not exercise a perceptible effect upon the magnet. His continued

experiments proved the truth of his suspicion that the voltaic current had an influence on the magnetised needle. He thought with reason, that exactly as a body, when penetrated by a strong current of electricity, radiates heat and light on every side, such might also be produced by magnetic action. His experience that lightning altered the poles in magnetic needles, which it had not struck, seemed to confirm this. But the true direction of the effect was still undetermined. He however succeeded in fully establishing it. In his lecture, when the decision of his long-cherished anticipation approached with unavoidable reality, interrupting himself for a moment, he immediately invited his audience to a practical trial; and even the first experiment was successful, though the effect was too feeble to give at once full validity to the law. It was, however, perceived that the glass was penetrated by the electric current, as well as by every magnetic effect.

For two centuries the opinion had been alternately accepted and rejected, that electricity and magnetism are produced by the same forces; yet all endeavours to prove the accordance had been in vain. Oersted now completed the evidence by his renewed experiments during several months with a very large galvanic chain of copper cells, of zinc plates, and a weak acid; that *there is always a magnetic circulation round the electric conductor, and that the electric current, in accordance with a certain law, always exercises determined and similar impressions on the direction of the magnetic needle*, even when it does not pass through the needle, but near it. Electro-magnetism was thus introduced into nature, not as an exception, but as a universal force of nature, which may be revealed in all bodies. A concise Latin account of the discovery of the preceding experiments was simultaneously sent to all the European capitals of Science, and Oersted enjoyed the greatest and best reward; namely, that his dis-

covery soon engaged the attention of the physicists of all countries; that it was extended by zealous inquiry and repeated experiments, and proved itself to be fruitful by a rapid succession of new discoveries; so that now it forms the basis of one of the principal divisions in books of instruction. Renown and honourable testimonials streamed in upon him from every side; many learned societies selected him as their member; the Royal Society in London sent him the Copley medal, and the French Institute, as an extraordinary acknowledgment, presented him with one of the mathematical class-prizes, worth 3000 francs.

We must bear in mind, when speaking of this great event of Oersted's life, that his services in experimental physics were by no means confined to this single phenomenon, although it may have cast the others into shade. In the following years his labours in a new edition of his work on Physics led to very important experiments on the compression of water, and when engaged in these researches, he invented an instrument by which a more certain method was attained of compressing liquids. By repeated experiments he succeeded at a later period to point out the hitherto doubted validity of the so-called law of Mariotti (for the compression of the air), even for a greater amount of pressure, up to the point where the gases become liquid. He proved the existence of a metal in alumina, and invented a method of separating it; farther, a new method to make chlorides out of oxides.

Assisted by the Government, Oersted undertook a third journey to Germany, France, and England, in 1822-23; he was chiefly occupied with the latest discoveries on light, and he brought back a number of important instruments. On his return home, he founded the Society for the Distribution of Natural Science, which, among other things, was the occasion of public lectures being delivered by its pupils

in the most important towns in the country. In 1823-24 he delivered a course of French lectures; and in 1828 travelled in Norway, and also visited Berlin, where he made an address in the Society of Naturalists, as he did likewise in Hamburgh in 1830. In 1834 he visited Gauss in Göttingen, that he might become better acquainted with his recent observations on magnetism, by which he was impelled to establish a magnetic observatory in Copenhagen. He took an active part in the Scandinavian meetings of Naturalists, which since the year 1839 had met every three years in one of the northern kingdoms. He attended the meeting at Gotheborg in 1839, and those at Copenhagen in 1840 and 1847; the Stockholm meeting in 1842, and that at Christiania in 1844. The principal speeches and papers he delivered, are published in the following volume. In 1836 he again visited Paris and England, and attended the Scientific Meeting at Southampton in September of that year. At the closing General Meeting the following words were spoken by Sir John Herschel, which may be inserted here to show the appreciation in which Professor Oersted was held by the philosophers of England:—

“ In science there was but one direction which the needle would take, when pointed towards the European continent, and that was towards his esteemed friend Professor Oersted. He knew not how to speak of him in his presence, without violating some of that sanctity by which, as an individual, he was surrounded. To look at his calm manner, who could think that he wielded such an intense power, capable of altering the whole state of science, and almost convulsing the knowledge of the world. He had at this meeting developed to them some of those recondite and remarkable powers which he had been himself the first to discover, and which went almost to the extent of obliging them to alter their views on the most ordinary laws of force and of motion. He

elaborated his ideas with slowness and certainty, bringing them forward only after a long lapse of time. How often did he (Sir John Herschel) wish to heaven that he could trample down, and strike for ever to the earth, the hasty generalisation which marked the present age, and bring up another and a more safe system of investigation, such as that which marked the inquiries of his friend. It was in the deep recesses, as it were of a cell, that in the midst of his study, a far idea first struck upon the mind of Oersted. He waited calmly and long for the dawn which at length opened upon him, altering the whole relations of science and, he might say, of life, until they knew not where he would lead them to. The electric telegraph, and other wonders of modern science, were but mere effervescences from the surface of this deep recondite discovery, which Oersted had liberated, and which was yet to burst with all its mighty force upon the world. If we were to characterise by any figure the advantage of Oersted to science, he would regard him as a fertilizing shower descending from heaven, which brought forth a new crop, delightful to the eye and pleasing to the heart."

Oersted quitted England at the close of the Southampton Meeting, and joined the Association at Kiel on his road home.

With reference to his worldly position, he had become Secretary to the Royal Society of Sciences in Copenhagen, Professor Ordinarius, a Corresponding Member of the Academy of Sciences in the French Institute, Director of the Polytechnic School at Copenhagen, which he had himself created by the personal influence he possessed with Frederick VI. In 1837 he was made Knight of the Legion of Honour, in 1840 "Conferenz-rath," in 1842 he was made Knight of the Prussian Order "pour le Mérite dans les Sciences et les Arts," in 1843 he received from Erlangen the diploma of honour as Doctor of Medicine, and in 1847 the Grand Cross of Dannebrog.

His extensive and various practical activity did not, meanwhile, hinder him from taking an animated and lively interest in the development of Danish literature, and in the political life which was awakened at a later period. The most influential newspapers frequently contained contributions from his pen, and in 1829 he appeared as a fellow-founder and a zealous co-operator in a literary monthly journal, which continued to exist till the year 1838. This was a most meritorious undertaking, by which limits were at length placed to the unintellectual tendency of Danish criticism which existed at that period, and which, like a hostile stream, threatened to destroy the healthy feeling for science and art. In the various criticisms of æsthetic and scientific works, which he published through this medium, as well as in treatises and essays which were otherwise distributed, he always exhibited an inclination, combined with rare capacity, to popularize general intelligence, and especially the knowledge of natural science, and to render it fruitful in the widest circles. Thus the whole course of his long life offers a rare example of indefatigable activity and of honest and many-sided effort. A long lyric and didactic poem which he composed, *The Balloon*, was translated into German by Johannsen, the minister of the German congregation in Copenhagen, in 1836.

As a teacher at the University he was always much beloved, from his unassuming manners, and his simple gentle demeanour in the delivery of his lectures, which, nevertheless, breathed an ardent spirit which could not be mistaken. He always met older as well as younger students, who needed any scientific explanation and assistance, in the most friendly manner, and, in many cases, where talent had to struggle with material obstacles, his kindly heart was even more than usually alert. Not alone naturalists, but all who were cultivated among the younger generation of Denmark, were his pupils. He not only benefited men by his labours, he was

also the first who began to give popular and scientific lectures to ladies, and by so doing he never relinquished the poetic and æsthetic interests which marked the stirring period of his youth. The freshness and activity of his powers of comprehension, which continued to the last, and his agreeable, as well as instructive manner of representation, not unfrequently remind us of Alexander von Humboldt. In Denmark, with its single University, all people of education form one family, more than in other countries; and among the thousands who attended his lectures during nearly half a century, not only did each of them carry home profit and a fresh stimulus from his words, but also a pleasing image of his friendly countenance, which was so often lighted up with genuine delight on the subjects of his lecture, and in the experiments which he exhibited. Not unfrequently in a flow of ideas and fancies, he was overcome by a certain absence of mind, but this was so completely a part of himself that it admitted of no censure; indeed, his audience would have been unwilling to lose it.

Since the year 1834, when liberal constitutional ideas began to stir themselves in Danish politics, and when the old forms began to be shaken, Øersted freely attached himself to the deliberate movement in advance, and by his popularity among the students, he had a calming and reasoning influence during periods of excitement; in 1835 he co-operated in the foundation of the society for freedom of the press; and when Christian VIII. ascended the throne, he addressed this prince, with whom, from the common love of natural science, he stood in close connection, in a speech of a most liberal tendency, proclaiming him to be the judge and representative of the enlarged liberal ideas of latter times. Nevertheless, Øersted's position and inclinations as a man of science necessarily hindered him from taking a direct part in the political life which was now developing

itself, but even here he continued to view, with lively interest, the active force of Nature and Reason.

On the 7th of November, 1850, a jubilee was held in honour of the fiftieth anniversary of Oersted's long and eminent services, at the University of Copenhagen. Deputations from the king, from the ministers, from the professors, and the students of the University, from the Polytechnic and Industrial Schools, flocked to him from all parts. Political differences were laid aside, and people of all ranks and opinions united in testifying their respect and affection to the old man, who, though in his seventy-third year, still retained youthful vigour, both in body and mind. The king presented him with new honours, and by the influence of his friends he received from Government a country residence near Copenhagen, which had been formerly inhabited by Oehlenschläger. A torch-light procession, conducted by the students, who sang verses in his honour, concluded the festivities of this day, which had throughout been of the most gratifying nature, for, by the description of an eye-witness, they were evidently prompted by the hearts of those who assisted in them. Winter passed, and Professor Oersted, ever active in mind and body, pursued his customary avocations of lectures and literary occupations, till the beginning of March, 1851, when he was attacked by cold, from which at first no serious apprehensions were entertained by himself or by his family. In a few days, however, inflammation in the chest ensued; he suffered little or no pain, but his strength rapidly declined, and on the 9th of March, scarcely a week from the commencement of his illness, he expired, surrounded by his afflicted family, and deeply regretted by the whole city of Copenhagen. His fellow-citizens, who a few months before had joined in expressing their gratitude for his long services to the University, now sought to alleviate their sorrow by contributing their share in the last proofs of affection, and respect which were

paid to their departed friend. On Sunday, the 16th of March, about a hundred scholars went in procession to the house of the deceased, where they laid a silver wreath upon his coffin, and after singing some verses which were composed for the occasion, they bore it, surrounded by torch-bearers, to the University, where it was laid in state in a hall hung with black. Here it remained till Tuesday, the 18th, when it was removed to the principal church (the Frue Kirke). The coffin was borne by the students of the Polytechnic School, and was attended by a procession headed by General Major von Scholler, who represented the King of Denmark. Then followed his Royal Highness the Hereditary Prince of Denmark, the Chamberlain, Baron Juel Rysensteen, representing her Majesty the Queen Dowager, Marie Sophie Frederica; the relations of the deceased, the Rector Magnificus of the Theological Faculty and the Clergy of Copenhagen, the Professors of the University, members of scientific societies, the Ministers, Foreign Ambassadors, a deputation from the Industrial Association, &c. A great number of all classes followed, so that the whole procession amounted to about 2000. A funeral march was performed as they passed along, and the bells continued to toll till they reached the principal entrance of the church, before which was arranged a guard of honour belonging to the civic infantry. The interior of the church was hung with black, and illuminated by candles. The coffin was placed on a *catafalque* in the centre, and the mournful ceremony was concluded by some more verses from the students, and an oration from Dean Tryde. The nearest relations of the deceased accompanied the coffin to the churchyard, where Pastor P. Hasle, the son-in-law of the deceased, spoke the last farewell words over the grave.—(*From the Biographical Sketch by P. L. Möller, &c.*)

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THE SPIRITUAL IN THE MATERIAL. (A CONVERSATION) . pp. 1—27

Two views of the world, the one proceeding from the consideration of the Spiritual, the other from that of the Material, which must be reconciled.

What we know most immediately of bodies is, that they appear as spaces, capable of producing effects.

The Material, as such, is subject to incessant change.

We may first of all assert that the Invariable, which exists in the changes of bodies, is the Unity of Thought, which we meet there.

This Unity of Thought, however, does not belong to us, but to Nature, for the laws of Nature are constant, and are at the same time laws of Reason :

Yet not proceeding from our Reason, but from that Reason which prevails throughout the universe.

May not this opinion of the general validity of Reason have originated from the essential peculiarity of our minds?

Refutation of this doubt.

Different remarks upon questions, which are to be afterwards explained.

A representation of the Variable further developed, and the importance of seeking for the Invariable in it.

The essence of a thing is determined by the combination of those laws, according to which all the effects which take place in it occur. These laws are properly called the Thoughts of Nature.

They constitute a oneness in every Essence, which may be called the Thought of the Essence, the Idea of the thing.

This Idea is not a mere Thought, but is realized through the forces which govern all things. The Essence of a thing is therefore its living Idea.

Ideas find a perfect realization in Nature.

Renewed doubts, whether the material of which things are composed, does not give them their peculiarity; and the answer.

Each thing is only part of a combination of things, which again is part of a more comprehensive combination, itself belonging to a still higher, and so on to infinity; it is the same with Ideas, of which they are the realization. Therefore the whole of existence is the work and revelation of living Universal Reason.

The reconciliation of the Thought of the essential similarity of Matter and Spirit consists in this, that the Material and the Spiritual are inseparably united in the creative Thoughts of the Almighty.

THE FOUNTAIN pp. 28—40

Repose beside a large fountain, and the impression it makes.

A demand for an explanation of this impression, and in what signification of the word it may be expected.

The impression that is produced by the water rising contrary to its gravity.

The impression that is produced by the increasing size of the rising jet of water.

The impression that is produced by the inward movement of the jet, and the consequent dispersion of the separate parts.

The different impressions produced by the sound of the falling drops.

The Beautiful exhibited in the figure which is described by the drops in their fall.

The connection of Reason contained in the combination of effects, is comprehended with pleasure by the inner sense, which is not indeed conscious of this Reason, though it derived its essence from All-governing Reason.

The various effects of light in the fountain increase the animation of the impression.

The impressions which are produced by fountains of different magnitudes and forces.

The impression of beauty in the Sublime and in the Great.

The impression of beauty in that which is full of life.

The Sublime, the Living, the Harmonious, considered as forms of beauty.

Reference to the eternal source of the Beautiful.

THE COMPREHENSION OF NATURE BY THOUGHT AND IMAGINATION

pp. 41—55

The struggle commonly prevailing between the comprehension of Nature by the understanding and by the imagination is the result of a defective education.

A perfect education at least requires that we should be just as well acquainted with Nature, as with the fabulous world.

How this contributes to self-knowledge is illustrated by an astronomical example.

There is something in the impression produced by the starry heavens which is common to all men, but it contains much besides, which gradually increases at every higher step of education.

The general impression of the starry heavens without the intervention of moonlight.

A moonlight night.

The impression of the stars on man in a savage state.

The impression on men whose powers of perception are somewhat awakened.

The impression on men who have reached the first step in astronomical knowledge. We here meet with higher, though still somewhat limited, notions of the magnitude and order of the world.

Slight alteration in these views, from ancient times to the days of Copernicus. The period commencing with him is taken as a whole.

In order that the results of scientific measurements of the universe may be comprehended by the Imagination, they must be submitted to its influence.

The same with reference to relations of time.

The impression of the starry firmament upon one who has cultivated his imagination by means of a clear comprehension of the System of the universe.

The result of our reflections is the belief that rational beings are distributed throughout the Universe.

The still more sublime impression, which is made on those who are thoroughly convinced that all existence is a dominion of Reason.

SUPERSTITION AND INFIDELITY IN THEIR RELATION TO NATURAL SCIENCE pp. 56—90

1. The nature of Superstition and Infidelity p. 56

An investigation of this subject is even now by no means superfluous.

A preliminary warning to those who attribute more than a casual connection between Superstition and Faith or Poetry.

Superstition is a tendency to believe something out of the ordinary course of Nature.

Since Nature, however, is the unceasing work of Eternal Reason,

Superstition is a tendency to believe in what is unreasonable.

This tendency is the degenerate state of an originally well-disposed mind.

Infidelity consists in a tendency to reject all *direct* certainty which does not proceed from the impressions of the senses.

2. *The origin of Superstition and Infidelity, and their mode of development* p. 61

The Beauty of the earliest comprehension of the world by man, must be itself destroyed by the forces of the world in order that the human race may be led to a higher point.

The enlightenment of the Understanding on natural events rouses in some people doubts concerning old opinions, in others a stronger attachment to them, and a hatred of new ideas.

3. *The Middle Ages an example of a period of Superstition* . . . p. 65

Christianity could not abolish that kind of Superstition which sought for aid from the devil.

Man's false comprehension has mingled the grossest Superstition with Religion.

We must set up the truth of History as a testimony against the one-sided eulogist of the Middle Ages.

4. *The injurious effects which Superstition exercises on all the concerns of life* p. 67

5. *On the supposed Poetry of Superstition* p. 69

It is not necessary for the creatures invented by Superstition to partake in external reality in order to receive poetical value; it is a prosaic error to demand this for the sake of poetry.

A true insight into things cannot approve of the arrogance with which some poetical works endeavour to give an external reality to those powers of darkness created by Superstition. The true kingdom of the Beautiful is a kingdom of Reason.

The desire entertained by some people to restore Superstition is wrong on this account, that no one is serious in desiring it, and that it only misleads some people into a belief in fictitious Beings.

A gross abuse of the words *poetic* and *prosaic*.

Natural Science certainly limits the poet with respect to the use of some representations which are contrary to reason; but—besides granting him rich compensation as a man, by higher insight into

Nature—she unfolds to him a new and rich poetical world, hitherto but little employed.

6. *The effects of Infidelity* p. 76

Infidelity is in fact as injurious as Superstition; but since it is usually created by the progress of Science, its suppression is more easily accomplished by still further progress.

Meanwhile it may give an ascendancy, which leads the country and its inhabitants to destruction.

At all times, there will be many who will neither be ruled by Superstition nor by Infidelity.

7. *How Science counteracts Superstition* p. 78

The eradication of particular notions is not the only effect performed by Science in its extirpation of Superstition, but it also exercises an influence by the spirit which it awakens.

The destructive manner in which Science operates against Superstition is more fully exhibited in a series of connected examples, whose chief force, in short, lies in this, that Nature is by them represented as governed by eternal laws of Reason.

Several examples.

The constant increase of an influential application of Natural Science in life, awakens an activity of thought, which is destructive to Superstition even among the hitherto less-educated classes.

About Superstitious notions which have no origin in Nature.

He who has duly appropriated the philosophy of Nature through his mental perception, as a rational Whole, must above all vigorously reject Superstition, which cannot, on the other hand, by one-sided knowledge be always excluded in particular directions.

8. *The Influence of Natural Science when opposed to Infidelity* . p. 86

Natural Science, indeed, herself refutes many false notions which she has occasioned; but the Harmony and the consequent Necessity which is exhibited in everything, is easily mistaken for a blind Necessity which precedes Reason, and is not comprehended as her result.

It is not sufficient here to recollect, that many naturalists have referred to a purpose and a plan in Nature, for the idea of necessity appears to contradict them:

But Natural Science exhibits to us the whole world as the work of the Divinity.

Necessity indeed appears to exclude the idea of independent wisdom, but they are indissolubly united in Eternal Reason.

ALL EXISTENCE A DOMINION OF REASON . . . pp. 91—133

1. *The Essential Unity of Intelligence throughout the Universe* . p. 91

This subject must be associated with Natural Science.

It must not be disdained, because our knowledge of it is still far from perfect,

The subject is not treated in a metaphysical manner.

✓Unity of Essence does not exclude the greatest variety in the forms of Existence.

The subject must be so treated as to represent truths for our contemplation.

A connected series of examples to show that the laws of motion are founded in Reason.

An inhabitant of Jupiter must recognize the laws acknowledged by us in the world surrounding him; and he would take a false view of these were his understanding faculty fundamentally different from our own.

Doubts of the correctness of our comprehension are refuted by the countless number of various and exact agreements between predicted and actual events in the Heavens.

Further considerations of the peculiar comprehension of Nature which we suppose belongs to an inhabitant of Jupiter.

Examples to illustrate the possibility of great dissimilarities existing together with similar essential unity.

Further development of the essential similarity of the understanding faculty in the inhabitants of Jupiter and those of our globe.

What has been said of the inhabitants of Jupiter may be applied in all essential matters, not only to the understanding faculty of the inhabitants of the other planets of our solar system, but still farther to those of the whole Universe.

The laws of Light are laws of Reason.

They are valid for the whole Universe.

It is shown in what manner essential similarity in the apprehension may be coupled with great differences.

As the effect of sound depends on vibrations which may occur in all bodies, so beings who are conscious of their corporeal condition, must have sensations which correspond to the sensation of sound.

✓Transition to the consideration of the worldly signification of the chemical laws of Nature.

✓The laws of Electricity, Galvanism, and Magnetism, are laws of Reason.

✓Historical remarks and anticipations on the development of Chemistry.

✓The properties which on earth we call universal, are equally so throughout the Universe.

The validity of the laws of Heat through the whole Universe.

✓ The universality of the laws of Electricity an additional proof for the universality of the natural laws of Chemistry.

A distinguished chemist, who thought he had found some grounds in his science to doubt the universal relation of gravity to the mass, tested them himself by experiment, and found his doubts refuted.

The similarity of matter in the Universe is confirmed by meteoric stones.

The other planets have been produced according to the same laws as the earth. As Man is the highest product of terrestrial development, the self-conscious beings of other planets must be the products of their development. If they are all produced according to the same laws, they must all have a fundamental similarity in the faculty of their Understanding.

2. *The fundamental similarity of the Laws of Beauty in the Universe* p. 109

The essential similarity of the understanding and the sensational faculties is accompanied by the sense of Beauty.

The sense of Beauty in the inhabitants of earth rests on the capability of receiving sensational impressions, and is produced in conformity with the same laws of Reason as the rest of Existence; by its reasonable nature it bestows a feeling of satisfaction: the same law must also prevail in the remaining portion of the Universe.

This is illustrated by examples taken from Figures and Forms.

Examples of the effects of Light.

Examples of the effects of Sound.

3. *The essential principles of Morality the same throughout the Universe* p. 114

We again begin with the consideration of the inhabitants of Earth, and it is shown how the will of free beings stands in subordination to the eternal laws of Nature.

The human race begins like the individual man, with simple faculties, which are to be developed by reciprocal influence with the rest of the world.

Already at the earliest stage in the development of the human race we discover a feeble germ of the consciousness of a God.

The earliest natural development of the consciousness of Duty and Virtue.

The more highly gifted Spirits lead and guide this development, and in so doing feel themselves inspired.

The still further development of the idea of a God.

In this development Natural Science contributes much to the banishment of idols.

Oscillations in this development.

The various systems of morality instituted by thinkers, all point to the Truth, that our will and our life must accord with Eternal Reason.

The trials which originate in Material Nature can only be rightly estimated when placed beside moral aberrations, and all the other errors belonging to mortality.

The true meaning of the opposition between God and the world.

How the abuse of human freedom has not the power to disturb the order of Eternal Reason.

The abuse of human freedom is still further exhibited, as an infinitely small effect, in connection with the whole.

These considerations, when combined, lead to the conviction that spiritual life on earth, in spite of many oscillations, develops itself more and more towards the realization of a kingdom of Reason.

The knowledge, insight, and faith of Man as an individual, are far from being exclusively his own work.

An application of the preceding remarks to the inhabitants of other planets.

Caution is requisite in this application.

4. *On the Intercommunication which exists between the Planets*, p. 130

Inasmuch as we possess some knowledge of the condition of other planets, those on other planets may also have some knowledge of the condition of ours.

Historical warning for doubters.

We progress in our knowledge of the condition of other planets.

In many of them they have probably advanced far before us.

A peculiar kind of Rational connection is developed through the whole Universe between finite thinking beings.

THE CULTIVATION OF SCIENCE CONSIDERED AS AN EXERCISE OF RELIGION pp. 134—142

Introductory words. A festival at our University, commemorating the Reformation, requires us to oppose the errors which threaten us, by watching the balance of truth, from which these would lead us away.

It is shown how the peculiar nature of Science requires that its cultivation should develop itself through Religion.

It belongs to the nature of Inquiry to search for the Eternal in things.

The fundamental forms of Eternal Reason are: Independence, Activity, and Harmony.

The same fundamental forms are met with in the Beautiful; namely, the Sublime, the Inspiring, and the Harmonious.

The Good we are to seek must be the really Imperishable.

Morality here becomes Religion, and requires that, with all our power, we should preserve the image of God within us, and realize his Will.

The forms of Virtue are: Independence, Activity, and Harmony. Its nature is briefly shown, and the duty is pointed out of spreading the kingdom of Reason.

The same duty requires that we should endeavour to attain scientific perfection in art, which implies thorough knowledge, clearness, and harmony.

It does not follow as part of our duty to Science, that every one should study Science. The high calling of the Man of Science.

From this follows an encouragement to young scientific men.

THE RELATION BETWEEN NATURAL SCIENCE AND POETRY.

pp. 143—163

The Remarks of Bishop Mynster upon the Soul in Nature gave occasion to these remarks.

The Thoughts of the Author upon the relation between Natural Science and Poetry, deviate far less from those of Bishop Mynster than was supposed by the latter.

The Author, namely, did not intend to say, that poets ought to exclude the sensational conceptions of nature from their works, when it did not harmonize with the scientific conception; but only that when they speak as men of the present day, they ought to avoid the false opinions formerly held upon the causes of things.

When our minds are transplanted into the life of ancient times, such false opinions are not discordant, but may be used with great effect.

An example of the want of harmony in the effect which a modern poetical work has sustained by scientific discovery.

The Author only considers Schiller's "Gods of Greece" as the expression of a poetical fancy, which proves nothing against Natural Science.

The Author's mode of apprehension contains nothing which lowers Genius.

Juxtaposition of the propositions referring to the relation between Natural Science and Poetry, in which the Author is of opinion that most people will easily agree with him.

Further explanations upon the importance of Natural Science to Poetry.

A passage is cited from the poem, "The Balloon," in opposition to expressions understood literally in Schiller's "Gods of Greece."

**THE RELATION OF NATURAL SCIENCE TO VARIOUS IMPORTANT
RELIGIOUS SUBJECTS pp. 164—191**

1. *The Invariability of the Laws of Nature* p. 164

That Natural Laws under different circumstances are accompanied by different effects, is not opposed to their Invariability.

Altered circumstances themselves occur according to Natural Laws. Explanatory examples, taken from the Laws of Motion and Attraction, considered in their validity through the whole of Existence.

~ Examples from Chemistry.

Examples from Vegetable Life.

A connected series of examples taken from the History of the development of the earth.

The Idea of the possibility of an existence which might appear, if the present universe were one day to perish, can have no influence upon our conceptions of the existing universe, and is therefore subject to no investigation here.

We should not allow our wishes to influence our Examination of Truth.

2. *Can the Government of God dispense with his arbitrary Will?* p. 172

While people are unanimous in ascribing the highest wisdom to the Divine government, opinions are divided upon the question, how far the effects of human freedom necessitate particular influential Acts of the Divinity beyond the usual legislation of Reason, or whether these effects are arranged in subordination to the Rational order of the Whole, by the Eternal Laws themselves.

The Author, who assumes the latter opinion, illustrates it through examples: A, drawn from Machines; B, from human arrangements.

The Inexplicable in events may be equally used as an objection against one or other of the opposed opinions.

It is a false idea to suppose that because we assume that the government of God happens according to Eternal Laws, we must necessarily represent God as inactive.

3. *The Development from the lower to the higher* p. 181

Everything in nature begins from something undeveloped, and progresses to higher and higher stages of development; not the reverse.

History has not exhibited a view in opposition to this with respect to nations.

That the whole of Nature was corrupted by the Fall may be refuted upon sure grounds.

4. *Some explanations in reference to what I have said about Faith* p. 183

The confidence which is awakened in us by those words of wisdom through which the Prophets of the human race have shown us what is hidden in the unfathomed depths of our own nature, can by no means be called Authority on Faith.

How Faith is awakened and strengthened by Divine influence in our daily life.

5. *Reason hidden in the Powers of the Soul* p. 186

If it appears that the Author grants too much to Reason, this arises perhaps because he has not sufficiently brought forward the difference between the two significations by which he understands the word, a limited and a more extensive one; the limited is the most usual, Reason itself known as Reason; the more extensive on the other hand also includes within it the Reason pervading everything, which constitutes that which is necessary to all actions.

6. *God and the World* p. 187

The Author is here again obliged to dispute the opinion, that Nature is dark and troubled. It only appears imperfect and decayed in the conception of the finite being.

The Author does not think that this doctrine is at variance with Christianity.

Complaints concerning the imperfection of the world pre-suppose the secret demand that mortality should not be Finite.

Nature itself is infinite; the more man's apprehension represents to him the parts as separated from the Whole, so much the more Nature appears to him as Finite. The image of Existence which is formed in the mind of man is darker and smaller in proportion as the stage of development upon which he stands is lower; but the more a man possesses comprehensive perception of the world, so much the more he participates in the rational life of the Whole, so much the more perfectly he sees God in Nature.

In the perception which God takes of the world, the Finite, as the Finite, has vanished.

ON THE INTELLECTUAL INFLUENCE EXERCISED BY NATURAL SCIENCE
IN ITS PRACTICAL APPLICATION pp. 192—204

An Introduction especially referring to the effect which the discoveries in the material world have upon minds.

Natural Science is necessary, in order to complete the education which at present prevails, and to free it from one-sidedness.

As Natural Science uninterruptedly progresses towards new discoveries, it has a refreshing influence upon the mind.

It leads to action, and by that means counteracts artificial dreaminess, which other education cannot alone accomplish.

He who educates himself by Natural Science has especial means to influence others in an intellectual manner.

Natural Science opens to artizans the most accessible road to cultivation.

The injurious effect of false directions in education, which the distribution of Natural Science may occasion, is inconsiderable in comparison with its truly civilizing influence.

That which artizans have to learn from Natural Science will not be too difficult for them.

Men of Science and artizans should respectively possess a knowledge of their several departments, and act on both sides with mutual confidence.

The artizan will only succeed and exercise an important influence on his own welfare and that of his country, when he understands the principles by which he acts, and is able to make discoveries himself.

Expectations of the future benefits resulting from the Institution.

Rejoicing in what has taken place among us in Science, and what does still take place.

SPEECHES DELIVERED AT TWO DIFFERENT SCANDINAVIAN SCIENTIFIC MEETINGS pp. 205—223

1. *Speech at the First Meeting of the Scandinavian Naturalists at Copenhagen* p. 205

The Scandinavian Naturalist Meetings will not only have an influence on Natural Science, but also on the national spirit of the north.

The Naturalist Meetings of the present day have for the most part not merely a scientific, but also a universally humanizing effect, and this not alone for the scientific men themselves; the people must also be taken into consideration.

Some of the effects proceeding from the personal meetings of Naturalists in the three northern kingdoms.

Effect of the friendly relations which, taken as a whole, prevail between Naturalists.

The influence of Natural Science upon Society, and the cultivation of the mind, advances so rapidly, that it also promises a great uniting effect in Scandinavia.

How important it is that the literatures of Scandinavia should appear as one literature, which may occur, without on that account either of the three resigning its peculiar character. While the scientific efforts of the northern nations mutually bind them to each other, they yet will not neglect to join still more closely in scientific fellowship with other nations.

Some proposals.

2. *Speech at the opening of the Fifth Meeting of the Scandinavian Naturalists* p. 214

Recapitulation of the ideas on the united scientific and national activity by which the first Copenhagen Naturalist Meeting began.

The attention is repeatedly turned upon the fraternity of languages. It appears, that Natural Science is and must be susceptible of a national treatment, as well as a learned treatment; and that it may thus exercise a great influence both upon the development of language and upon the cultivation of the mind.

The objection which is brought forward against the great national influence of Natural Science, that it is not an affair of the people, is founded upon a misunderstanding, and will be destroyed in the further development of Natural Science.

OF THE SCHOOL IN LIFE pp. 224—243

1. *The Relation between the Young and Old, with especial reference to young men on their first entrance into the world* p. 224

Introductory words.

The Author wishes to consider the relation between young and old, according to the method of Naturalists, whilst he determines upon those laws of existence by which it must be regulated.

Many wise proverbs upon this relation have less influence than they should have, because they are only regarded in the *form of Experiences*. They may be represented as *Laws of Existence*.

Laws for the development of the child, and its relation to the parents.

Untimely endeavour to quit school.

Reciprocity between the father and the son who is growing up, between the teacher and the pupil.

The relation in which the young man stands to maternal love.

The period of youth has its own peculiar signification in life, and its own laws of development.

The reciprocity between young and old is beneficial to both classes.

The youth must allow himself to be guided in his judgment of the activity of the elder portion of the world by the laws of

development of mankind, and he must respect well-earned merit, as far as this appears in the light of his age.

- The Author advocates peace, because the hostile passions have now so much power.

2. *A speech delivered on the reception of Young Students as Academical Citizens* p. 239

The University may be regarded as an organized body just as much as the state.

A glance at the feelings which must prevail in the assembly, both among the teachers as well as among the old and new academical citizens.

The free scientific life is now unfolded to the new academical citizen.

Delight in Science is the true sign of the genuine student.

Encouragement to a true scientific life.

ANCIENT AND MODERN TIMES pp. 244—256

1. *Is the World degenerated?* p. 244

For many centuries complaints were brought forward at each period, that it was worse than the preceding; if this had been well grounded, the world would now be very miserable.

2. *The Temperature of the Atmosphere has not altered* p. 244

The oldest descriptions of the condition of Greenland, 600 years ago, represents it just as it is now.

The Bible shows that vegetation in Judæa was the same in the most ancient times as it is at present; therefore that the moderate temperature has remained the same.

The olive-tree 1800 years ago had the same northern limit in France as it has now.

References to Schouw's investigations.

3. *Men were neither greater nor stronger in ancient times* p. 246

This is proved by the bones and skeletons of men who lived thousands of years ago.

The arguments that are brought forward to prove that men were once stronger, rest upon misunderstandings.

4. *The duration of Life is not diminished. We now enjoy better Health* p. 248

The number of men who reach a great age is greater now than it was formerly, because we are more particular about cleanliness and health, and live more moderately.

5. *Mankind, in a moral point of view, has not receded, but has advanced* p. 250

We must derive this information from the coteremporary historians of former centuries, and not trust to the one-sided representations of more modern times.

Valour was certainly more practised in lawless times, but the present day has equally strong examples to bring forward.

Our opinions concerning the honour which existed in ancient days are quite groundless.

Enlightenment has assisted Christianity to improve men, to abolish Superstition, to extinguish Ambition, Arrogance, and Cruelty, and to awaken the spirit of Love.

Examples taken from the modern history of our country.

We should neither despise Ancient Times, nor regard our own as perfect.

NATURAL SCIENCE IN ITS RELATION TO DIFFERENT PERIODS OF THE WORLD, AND TO THE PHILOSOPHY PREVALENT THEN.

pp. 257—288

CHRISTIANITY AND MENTAL CULTIVATION MUTUALLY SUPPORT EACH OTHER pp. 289—299

Although the numbers of years which give rise to our Jubilees are arbitrary, it is still an excellent thing that such festivals should be solemnized.

At the Jubilee solemnized by the University, in commemoration of the thousandth anniversary of Christianity in our country, it is suitable to consider how Christianity and Science support each other.

That the Sciences began to decline at the same period as the extension of Christianity, can in no way be ascribed to the influence of the latter, but to the corruption of morals, which gave the preponderance to the barbarous above the civilized national elements of those days; whereas there exists a power in Christianity to civilize barbarous nations.

This power depended as much upon the Divine Government of the World, which was revealed in the distribution of Christianity.

It was also aroused by inquiry; the teachers of religion became the promoters of Science, and the monasteries their principal refuge.

Christianity gave occasion to a general study of languages, which was accompanied by a great civilizing effect.

There has certainly often been a contest, and frequently a very strong one, between the friends of Christianity and of Enlightenment; but even where the will was not good, it nevertheless afterwards served both Religion and Truth.

Christianity would establish a kingdom of God upon earth, which in consequence of its nature is also a kingdom of Reason. While Science strives after the same aim, and contributes much to the uprooting of the passions, and the development of Reason, it supports Christianity.

1803
OBSERVATIONS ON THE HISTORY OF CHEMISTRY . . . pp. 300—324

The various changes in Chemistry p. 300

Doubts caused by the changes in Science.

Immeasurable difference between the Alchemistic views and our own.

The Phlogistic period.

The Antiphlogistic period.

The commencement of the Electro-chemical.

Everything in Science prevailing throughout a certain period, contains actual Scientific Truth, though frequently much obscured . . . p. 307

A preliminary survey of the subject.

The truths and anticipations of truths in Alchemy.

Comprehensive Truths contained in the Phlogistic System.

Nature of the Antiphlogistic System.

Fundamental features of the Electro-chemical Theory.

Retrospect of that which harmonizes in all these theories.

That there is a true course of development in the theories which have followed one another, and which have been successively solved, p. 313

The new Theory embraces far more than the former, and has a far greater inner connection.

Science develops itself with increased rapidity, and arrives at a greater intellectual apprehension.

The Development of Science obeys certain Laws p. 315

The harmony in the law of development belongs to the nature of the thing, but is here represented by examples.

It belonged to the nature of the thing that metals constituted the first object for a combination of chemical phenomena.

Experiments on the metals must lead to the knowledge of other substances, and make Chemistry a Science of separations and re-combinations.

At a much later period, a more scientific treatment of the gases was attained.

The Antiphlogistic Chemistry first became possible by this knowledge, but was also made necessary.

Those effects which are imperceptible by their weight, become

objects of scientific application in chemistry by previous preparation, which is obtained through a one-sided knowledge of matter.

The natural course of development of the doctrine of Electricity.

Accidental discoveries, so far as they do not belong to the course of development of Science, exercise no essential effect upon it.

A closer view of the Law of Oscillation in the development of Science, and its beneficial influence p. 320

There is a changing discovery and extension of the limits in the development of Science in certain periods of time, and distinct traces of correction and limitation in others.

This Law is a universal Law of Life, and promotes the Life of Science.

It is very beneficial to the students to make themselves well acquainted with the revolutions in Science.

Comparison of the development of Science with the development of the Earth.

This agreement between Nature and Spirit is not accidental, but founded in the nature of the thing, and points to a higher physics, in which the harmony of the Whole must be represented.

TWO DIALOGUES ON THE FUNDAMENTAL PRINCIPLES OF BEAUTY, AND ON THE PHYSICAL EFFECTS OF TONES . . . pp. 325—371

THE SAME PRINCIPLES OF BEAUTY EXIST IN THE OBJECTS SUBMITTED TO THE EYE AND TO THE EAR . . . pp. 325—351

Apparent sources of this pleasure.

Music is a mere enjoyment of the senses.

This pleasure does not depend upon accidental circumstances, but upon the nature of the receiving organs of sense; it depends on the necessary nature of things, therefore on Reason, with a consciousness of Enjoyment. Bodies are organized alike, but souls are dissimilar.

The pleasure derived from Music depends upon the Imagination.

The source of enjoyment cannot be discovered.

A refutation of this mode of reasoning.

Our pleasure in music depends upon Reason and the senses at the same time, not however upon the external senses, but upon the internal, upon Perception.

Consideration of the Circle in reference to this.

Idea is the perceptive oneness of Thoughts, comprehended in the Reason as Perception. This is comprehended in the Beautiful.

The Beautiful pleases us as the impression of an Idea, without our being at the same time conscious of it.

Application to other mathematical figures, the symmetrical and the unsymmetrical.
 The Geometrical figures are infinitely repeated in the whole of inorganic Nature.
 Inorganic beings constitute the elementary geometry, Organic the higher geometry of Nature.
 If deviation from a figure seems ugly to us, we must attribute some Beauty to the figure itself.
 Acoustic figures as applied to music.
 No beautiful sound can be produced except by symmetrical vibrations of the sounding body.
 There is a hidden Reason in Tones.
 The ear, like the eye, prefers simple relations.
 The chord of the major third is therefore the most beautiful of all.
 The relations of tones are founded on mathematical principles, and may therefore be calculated. But our enjoyment does not depend upon that.
 The true Musician does not calculate them, since his work is essentially poetical.
 Thus we may calculate upon the sources of the enjoyment of art which does not consequently depend upon the imagination. The arguments are drawn from the nature of the thing.
 Music is certainly an enjoyment of the senses, but one of the noblest of them, and the organ of hearing is one of the most delicate and most skilfully constructed. Inferior perceptions of the senses cannot be reproduced by the inner sense, as the higher can.
 Results of the whole investigation.

THE PHYSICAL EFFECTS OF TONES . . . pp. 352—371

An inquiry as to the cause why music creates a desire to dance, and at the same time regulates the movements of the dance.
 The effects of Tones, or rather the vibrations of Tones, upon inanimate things.
 A string when it is sounding causes another to vibrate which is tuned alike. The air being set into vibrations is the cause of this phenomenon.
 But the strings which are tuned alike are also sympathetic. This is explained by the curves of the string which is struck.
 A string which has been struck does not merely affect others which are tuned alike, but also those which are in harmony.
 Comparison of human sympathy with that between strings: strings that are tuned alike support each other, strings that are out of tune hinder and disturb each other.
 New questions: Are the nerves set in motion by the vibrations in

the same manner as the strings? There is only a distant similarity between them. The nerves of the ear receive impressions; each pressure is connected with a development of heat, and the return to the former condition with cold, though this is imperceptible to us.

The vibrations on the nerves which are produced by tones commence from the nerves of hearing, and thence proceed to the brain and to all the nerves. Comparison with other vibrations.

The variety of vibrations do not confuse one another. Examples. Time-music and Tone-music. The first regulates arbitrary movements, the last the soul, but also inversely. A wider sphere of action for music. Condemnation of the present mode of musical instruction, and proposal for its improvement.

Necessity for a deeper investigation into the Beautiful.

TWO CHAPTERS ON THE NATURAL PHILOSOPHY OF THE BEAUTIFUL.

pp. 372—413

1. The investigation does not begin with a determination of the notion of Beauty, but with an inquiry into the Laws for the production of the Beautiful, by the most simple objects, mathematical figures. The straight line, the circle, the right angle, are pleasing to the eye, and indeed have an inward sensational comprehension, a mental perception, through a union of the various.
The Beautiful is the Idea expressed in things so far as it is reconciled to perception.
Symmetry alone satisfies the sense of Beauty.
Comparison of forms which are produced by nature and by thought, with especial reference to the mutual crossings of the circles of waves, the acoustic figures, and the laws of the Relations of Tones.
The relative condition of strings as sympathy.
The effects of tones do not merely belong to Nature.
The Laws of Nature in the Material World are Laws of Reason.
2. Sound and Light are produced by vibrations, the first in the air, the latter in æther, whence the whole Material World is penetrated by imperceptible movements: Heat is likewise an inward vibratory movement, which is connected with the chemical, electrical, and magnetic condition of bodies.
The importance of Light for the outward and inward condition of mankind.
We are unconscious of Light, without the opposite impression of darkness.
In Symmetry there are the opposites of forms, in Light those of effects; in the former the sum of Thought (the Ideal), in the latter the sum of Reality (the Real), is most prominent.

- Relation of surfaces to Light. Two modes of reflecting Light, mirror-reflection and the dispersing or dissolving reflection. It is only the last that gives us cognizance of the reflecting parts.
- Unequally rapid *Æther*-vibrations yield different perceptions of colour. The distance of the waves is called the breadth of the waves.
- The *Æther*-vibrations for the perception of red, have the greatest breadth of wave; then follow yellow, green, blue, violet. The latter has the smallest breadth of wave. The reflection of a very small number of rays, forms black, the opposite, white pigments. The effect of smaller and greater coloured surfaces.
- Colours, with regard to their application to dress, to houses, and their signification.
- The impression of colours in consequence of their indirect relations, especially from the ordinary notions of society.
- The symbolical signification of colours.
- Certain colours by their union yield white light.
- Complemental colours, or harmonious colours.
- Application of the Philosophy of Beauty to the vegetable kingdom.
- The influence of a shining surface in the relations of Beauty.
- The impression of colours on the nerves of the eye. The combined forces of the world express themselves in the sensation of sight, although they may be concealed.
- The nature of the eye brings along with it the development of harmonious colours.
- On the Rainbow and Interference, with examples of the connection that exists between forms and colours.
- Conditions of polarization.
- On Colour-Music.

ON THE UNBEAUTIFUL IN NATURE, IN ITS RELATION TO THE HARMONY OF BEAUTY IN THE WHOLE . . . pp. 414—424

Reference to the Dialogue on Tones.

On our inner sense, and its power of forming an image of things of which we have never received a direct impression from the senses: example, taken from maps.

The inner sense in its power of comprehension and production is called the Imagination.

The Imagination has three especial stages of development.—1. The real natural sense. 2. The cultivated natural sense. 3. Sight through knowledge.

Single parts of a whole do not sometimes appear beautiful: *e.g.*, a tree, stripped of its leaves, standing alone.

Many things only appear beautiful when seen in their proper

natural position: *e.g.*, the swan, which we are accustomed to see in its natural position.

The case is totally reversed with regard to the ape, which we seldom see in its natural position.

The Bat is ugly in another respect, because it appears unnatural to the imagination as a creature between the mammal and the bird. Something similar occurs in the case of monsters.

The poetic spirit has an influence on our comprehension of Beauty: *e.g.*, in the lion and the serpent.

Remarks on fictitious forms: *e.g.*, the wings of angels depicted in art.

Corruption. Individual external signs of death may be employed by the Artist, and the Poet may use still greater freedom.

All that is apparently unbeautiful or ugly in a spiritual sphere of apprehension will form a part in the beauty of the Whole.

Ugliness, as in a certain sense Evil, becomes a finite condition: that which is essentially beautiful is eternal.

CHRISTIANITY AND ASTRONOMY pp. 425—446

Preliminary Remarks.

Absurdity of the opinion that the Copernican system rests on a concertation of Astronomers.

Our belief that the Heavens and all the Stars were created for the Earth alone, has been shaken by discoveries which have been made since the time of Tycho Brahe, as according to his system we are compelled to believe that the Heavens revolve round the Earth.

A Refutation of the objection that the Copernican System, according to which the Earth goes round the Sun, is in opposition to a manifest testimony of our senses.

Our senses are deceived. The Understanding must come to our aid. By our understanding, we calculate the eclipses of the Moon and Sun, we invent machines, make laws for the State, &c.

Mode of judging the axiom, that because our understanding may err, we must therefore hold fast to the Word of God.

The Astronomers do this also; they read the book of laws for the movements of the world which God has written in the heavens, first by aid of their senses, afterwards by the experience of thousands of years, and finally by calculations, and a comparison between the same and phenomena.

Mathematical predictions are quite distinct from prophecies.

There are two kinds of precalculations; one founded on observations, the other on an insight into the laws of Nature, which we owe to Newton.

Newton developed the thought, that the movements of the planets occur according to the same laws as the movements here on earth. Before the time of Newton, the law of Inertia was already known. That Bodies have forces, but they are wanting in will to employ these forces.

The thought that Matter is devoid of will was known to Galileo, and it was through Descartes that it received universal acknowledgment.

Gravity is a result of reciprocal force of attraction in all material things throughout the world.

Explanation of this law, with reference to a diminution in its effect, in proportion to the distance of two objects from one another.

This determination in the effect, which arises from the attraction of all parts in a sphere, is so constituted as if all these parts were in the centre. This facilitated the calculation of distances.

Our observations on the Moon's path confirm these calculations.

The paths of all the planets and their moons may be calculated by this universal attraction.

Newton's theory also proves that the figure of the earth entirely depends on the same universal laws of Nature, as on the laws of Motion, belonging to it, and to the other planets.

The Newtonian theory seems to be opposed to the Bible, but many passages of the Bible cannot be taken literally. When taken as a whole, the Bible rather teaches the movement than the fixed position of the earth.

Refutation of the objection; the falsity of the opinion that all Christian consciousness is opposed to the doctrine of Astronomers, as well as the view that Natural Science leads away from God, and that it would make us believe the world to be governed by blind laws in Nature.

Naturalists, as well as others, believe that the whole world originates from God, that the laws of Nature are regulations which God has himself given, and has not received from another.

The more correct view, is that all existence is the unceasing work of God. That natural laws are the continual operation of Divine Reason must be submitted to our consideration.

We may certainly be good Christians, with pure child-like faith, without either understanding or admitting any Astronomical system whatever, but we must not thoughtlessly reject scientific opinions, or even view them with indifference.

- ✓ Every piece of knowledge which is properly understood serves Christianity. Science, as well as religion, endeavours to raise us above the impressions of our senses. The pleasure we receive from every spiritual enjoyment is an approach to God. Astronomy both humbles and elevates us.

UPON THE SPIRIT AND STUDY OF UNIVERSAL NATURAL PHILOSOPHY.
pp. 447—465

Spirit, Signification, and the End of Natural Science . . . p. 447

The universal aim of Natural Science.

The infinite magnitude and variety of Nature, both in extent of Space and Time, in Divisibility, in Variety.

Such an infinite Science is only rendered possible by everything happening according to universal Laws.

Natural Laws and the universal fundamental forces of Nature, constitute that which is constant in everything; and the peculiarity of each thing is determined by the laws.

In each thing, the Laws by which it is produced constitute a totality; each individual thing is part of a greater totality, which again is part of a still higher totality; so that the whole universe must be recognized as the true infinite oneness of all Natural Laws, viewed in their activity.

Natural Laws are Laws of Reason, which may also be named Natural Thoughts. All Thoughts in Nature are only expressions of an infinite living Reason.

The human mind recognizes itself again in Nature, and also recognizes itself as the image of the Eternal Creating Reason.

Science is not to be sought on account of its utility, but on account of its peculiar excellence; yet the consideration of its utility belongs to the completion of the Insight.

Natural Science strengthens the Mind for the action which is expressed in Life, and destroys Superstition. It teaches us to govern Nature.

Methods of Universal Natural Philosophy . . . p. 454

Universal Precepts.

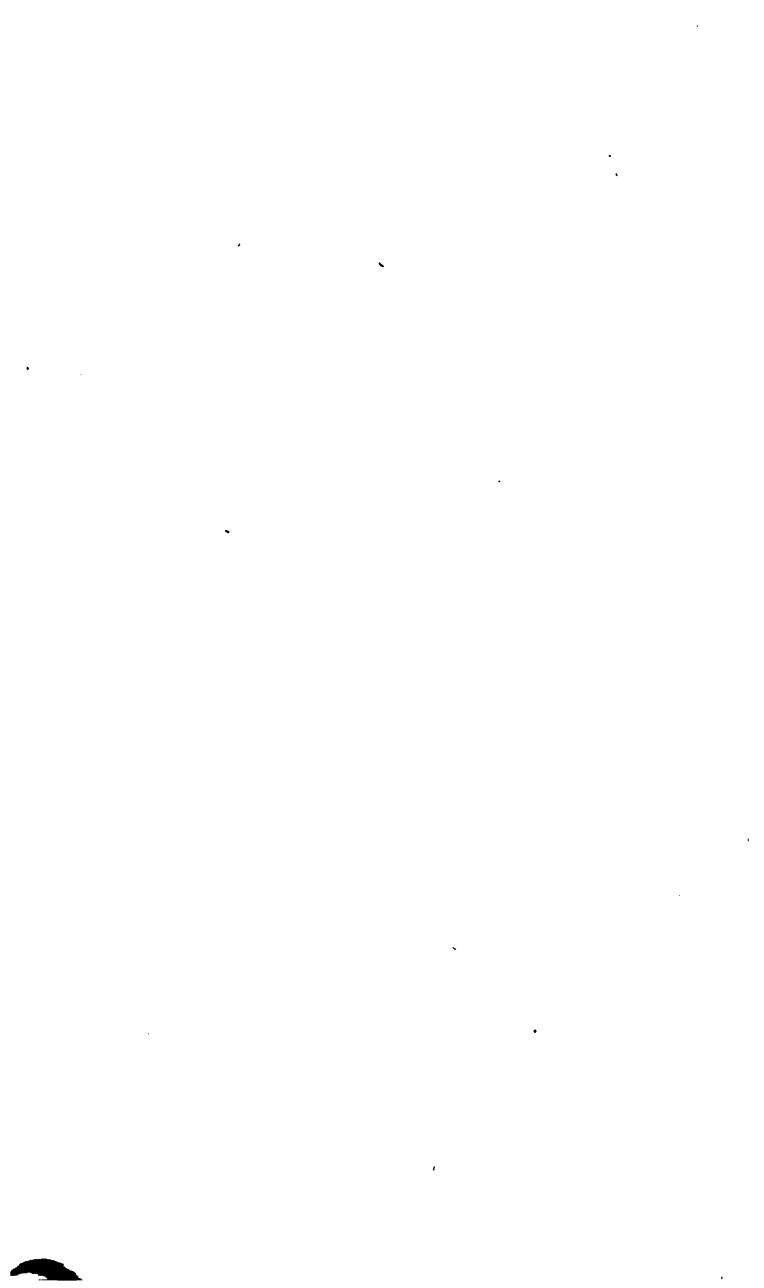
Daily Experience, Observation, Experiments.

Closer Representation. Experimental Art.

The meaning of Experiment. Experimental Idea.

The relation of Mathematics to Natural Philosophy.

Hypothesis is an Experimental Idea. Use and proof of Hypothesis.



THE SPIRITUAL IN THE MATERIAL.

A CONVERSATION.

ALFRED. SOPHIA. FELIX. HERMANN.

SOPHIA. Here we are all assembled again this evening, which is so fine that it seems to invite us to pursue our conversation of last night.

HERMANN. We all participate in your wish. You said yesterday, dear Alfred, that you were both a Spiritualist and a Materialist. As I know that you did not assert this in a spirit of mere dogmatism, or from an idle wish to be peculiar, I should like to hear you explain yourself.

ALFRED. We must touch upon one of the great questions of philosophy; but I will, to the best of my power, endeavour to prove the justice of my conceptions.

SOPHIA. I may appear presumptuous, but I cannot refrain from saying how much I wish to comprehend these things, and therefore I beg, Alfred, that you will, if possible, so express yourself that the unlearned, such as I am, may be able to understand you.

ALFRED. I will endeavour to do so. But lest I should omit anything which, were I speaking to my friend Hermann alone, I should conclude he already knew, I will address myself to you, Sophia, and beg him to object whenever we assume anything as settled which he considers erroneous.

HERMANN. I willingly comply.

SOPHIA. My earnest wish will then be fulfilled.

ALFRED. I must therefore begin with a question, which you will perhaps think somewhat irrelevant to the subject. How do we gain a knowledge of external things?

SOPHIA. Through the senses, I imagine.

ALFRED. And do the senses enable us to comprehend an entire object at once?

SOPHIA. I have not considered that.

ALFRED. When I lay my hand on this book, do I feel the whole book, or only an effect of the book, namely, a resistance against the motion by which my hand would force itself into the space occupied by the book?

SOPHIA. The latter is certainly the true state of the case; but do I not see the whole book?

ALFRED. Surely not the whole at once?

SOPHIA. Certainly not; some parts are concealed by other parts.

ALFRED. We are very often deceived by our eyesight: under particular circumstances the reflection in a looking-glass, or a faithful likeness, may deceive the eye into the belief that it sees a material object.

SOPHIA. That is true.

ALFRED. We therefore recognize the existence of a material object, not from a single impression made upon the senses, but from our mental capacity having combined many sensible impressions together.

SOPHIA. Yet a single look often convinces me of the reality of a thing.

ALFRED. I am far from denying that; and would even allow that it is generally the case. But when a single look convinces you that it is a book which you see, innumerable previous impressions, in conformity with the contrivance of our being, are renewed within you; so that the object appears entire, though a very small portion of it may have been at that time impressed on your senses.

SOPHIA. I might therefore be deceived if it were not surrounded by all which usually accompanies it. Indeed, I now remember much that might have satisfied me of this before. I once saw those delusive images which are called *Fata Morgana*, or reflections in the air, and for a long time felt convinced that what I saw before me were real houses, trees, and water. I remember also a remarkable experiment made with a concave mirror, by means of which a flower appeared suspended in such a manner over a flower-pot, as to lead one to mistake the image for the reality.

ALFRED. Thus we do not immediately perceive objects, such

as a tree, a house, or a book; that which we actually grasp is the impression produced upon us. But this impression is certainly an effect which could not be produced without an active power in the things themselves. We have therefore this only to recognize. *an active power*

S. I do not see how I can deny this; and yet when I think of a lump of metal, a stone, or a log of wood, so far from imagining anything active, it appears to me as if everything about them were dead; they are so immovable and so entirely opposed to all activity, that the nature of matter seems to consist much more in passive existence than in constant action.

A. But that view of the subject will not stand the test of experience. If you lay one stone upon another, does not the lower one support that which rests upon it?

S. Of course; but does this proceed from an active power?

A. How can it be otherwise? When anything is effected, there must be some effecting power at work. In the case above mentioned, the effect produced is this, that the upper stone is interrupted in its constant endeavour to fall.

S. I have nothing to say in reply; and yet it appears to me that there must be a passive resistance.

A. You are quite right to mention your doubts. There is no such thing as passive resistance, though we have more frequently been deceived into that idea than we could conceive it possible. But do not be deterred by a philosophical dogma; the explanation of the phenomenon must proceed from a consideration of the thing itself. Let us therefore re-examine our case. Do you not believe that the upper stone presses upon the one beneath?

S. Certainly.

A. And that the one beneath is pressed upon?

S. Of course.

A. But is not that which is pressed upon, also pressed together?

S. Yes, very often; but does it always happen? It does not appear to me that a stone is pressed together when anything is laid upon it.

A. A stone is only slightly compressed; but it has been ascertained by means of very delicate measurements, that all bodies are capable of being compressed.

S. But an enormous weight would be required to compress a stone.

A. To press it together, so as to make it only a thousandth part smaller, would require an immense force; but should the pressure be less, the diminution would be in the same proportion lessened, though, at the same time, ever so slight a pressure corresponds with a certain compression.

S. Well, if this is proved by experiment, I am far from wishing to contradict it, as it appears to me very probable.

A. As soon as the pressure ceases to act upon the stone, it will return to its original size.

S. Is this always the case?

A. Yes, if the pressure be not so great as to crush it internally.

S. I therefore understand that there is a constant counter-pressure from the body which is pressed upon, against that which is pressing, and that it consequently opposes an effectual resistance to the body which endeavours to force itself into its space.

A. Bodies, therefore, possess an inward power of acting' by means of which they occupy space. Thus, when you feel the presence of this table with your hand, you are really made aware of it by the active power it possesses of filling up space; and every other impression which you receive from material things is also only a notification of an inherent power of acting which they possess. You would see nothing, if objects did not possess the power either to evolve light, or to reflect back some of that which falls upon them, that your eye may be able to catch part of it. But I need not bring forward any more examples; I do not doubt that you perceive with me that every impression implies an active power.

S. I ought not to have been so long in comprehending this, as it is self-evident.

A. What we most directly know of bodies, accordingly, is, that they are spaces filled by active powers.

S. Then matter is more nearly related to spirit than we generally imagine. But now that one difficulty is removed, I here encounter another. I see that matter is resolved into mist and vapour, which I cannot reconcile with the evidence of my senses.

A. You appear to imagine it to be an extravagant idea thus to resolve material bodies into mere phantoms of clouds

Facilitator
of action
Active
power

What are
bodies

and vapour. But what will you say when I assure you that the possibility of this has been proved by innumerable scientific investigations on matter.

S. How so?

A. It has been effected by chemistry.

S. Alas! I understand nothing of this branch of science.

A. That will not prevent me from giving you some instances derived from it. Ice, as you will allow, is a solid body, but if it is penetrated by a certain amount of heat, it becomes water, and this same water, submitted to a still greater amount of heat, becomes invisible steam. Now the actual amount of matter which is determined by its weight, remains throughout these different conditions unchanged and the same. This, however, holds good not only in regard to water, but to all other bodies. I need not tell you that hard iron becomes fluid when exposed to great heat; but perhaps you may not have heard that at a certain degree of heat iron may also be converted into vapour. I cite this example, because it so strikingly contradicts the common ideas which are entertained concerning matter. There is one universal law, as has been already said, namely, that all bodies may exist, either as solid, liquid, or aeriform; and I may casually remark, that vapour and air do not essentially differ. But I do not stop here. The most simple bodies seem to have the strongest tendency towards an aeriform or gaseous condition. Water, which was so long considered to be an element, can be separated by the aid of chemistry into two component parts, each of which is in itself a peculiar kind of gas, and which, reunited, forms water, without the change having any influence on the quantity of the whole. That I may not name objects beyond the sphere of common life, I shall only mention that sugar, wood, horn, and many other solid bodies in the animal and vegetable kingdoms, may also be decomposed into gaseous parts; indeed, it is very probable that one day it will appear that all bodies are composed of gaseous elements; that is to say, of matter which in some bodies is able to maintain its gaseous condition at a lower degree of heat than in other bodies.

S. I am willing to believe this; but still it has not cleared up my difficulty, although it may appear to have done so.

A. I did not really expect that it would. You have hardly discovered the right expression for your doubt.

S. Why did you not warn me of this?

A. Because I supposed that the difficulty which I have just noticed formed the chief part of your doubt, though you had not yourself taken it into account.

S. I believe you are right; but in what else do my doubts consist?

occupants of space
A. You miss, in my representation of things, the consistency to which you are accustomed in the material world. To what I have besides said you will reply: it is not only density and solidity which I miss when I imagine material objects are merely occupants of space, but I cannot also at the same time conceive the possibility of the existence of such various defined and enduring forms as I everywhere behold in the material world.

S. I confess that this does appear to me a great difficulty.

the changeability of the world
A. Then I would beg you to join with me in a still closer observation on that which is the perishable part of the material world, that we may more surely seek the Imperishable where it is to be found. The perpetual mutability of the human and of all animal bodies need hardly be mentioned. Daily experience proves to us they are born, grow, decline, and perish, and that one generation ever replaces another. This phenomenon is no less manifest in the vegetable kingdom. Flowers and grass, especially those plants which have but a year's existence, have at all times served as examples of mortality. Even mighty trees, which have endured for centuries, are subject to the same mortality, although longer deferred. Even our globe, which, according to the vulgar notion, bears all things on its firm basis, is subject to change: it revolves, as you know, daily on its axis, and annually completes its course round the sun. But the sun itself describes an orbit as yet undetermined by us, and is now advancing in a vast journey, in which the earth and all her sister planets must necessarily accompany him; but the centre around which the sun describes its apparently immeasurable course, may also, with the greatest certainty, be regarded as moving; in short, all the heavenly bodies are incessantly in motion, and none are at rest.

S. Although I have never so pictured these things to myself, they are nevertheless not strange to me; but does it, therefore, follow, that inanimate nature is just as changeable as the rest? Surely there exists something which is invariable.

A. Very true! The Invariable does exist, but we must not seek it here. The earth has not always been as it is now; its internal structure testifies that for thousands of years it has been developing from one condition to another, and the attentive inquirer must be aware that it continues constantly to develop itself, and that now, as formerly, it is passing from one state to another. We may easily conceive that the same is taking place with all the other heavenly bodies, which are therefore not only in constant motion, but, at the same time, are in an unceasing state of developement. Inaction or repose exists not in the universe.

S. Well, I shall see what you say when you come to speak of inanimate objects; for our earth and the other heavenly bodies appear to bear a strong resemblance to animate nature, however much they may differ from them in many respects.

A. But we must take into consideration, that these inanimate objects upon the earth are only portions of the earth itself, and, consequently, develop themselves, and, moreover, will continue to be developed with it. The sea-shore, spread out so beautifully before us, has not been always there; on the contrary, there was a time when it had not risen above the surface of the water. Even the hardest rock has had its period of formation, since which it has suffered continual changes by the influence of the air, water, heat, and cold. The plants which grow on the surface of the rock help to consume it; and who can tell how many other forces may co-operate in the work! Subterranean forces are constantly striving to raise or sink the rock, which, when apparently in a condition of repose themselves, are by no means inactive. When they really effect any elevations or depressions, it takes place so slowly, that it would escape observation, if one century did not assist another. Amidst all these formations and transformations of the earth, the materials, out of which it is compounded, are also formed and transformed, for these materials are not distinct from the earth, but belong to it as much as bones, flesh, and blood, belong to the bodies of animals.

S. But are there not substances which endure for whole centuries unchanged? I have seen antiquities of glass, stone, and gold, which had lain an immense time underground.

A. But during that time they have not been in a complete state of rest; they have undoubtedly been subject to

the universal laws of matter; and I must previously remark that, whatever we may think of this apparent repose, it is only an oscillation between equally great antagonistic powers.

S. How is that?

rest
A. Urged by gravity to fall, bodies are only prevented by an antagonistic force in those which oppose them, as we have already seen. All bodies lying upon them will endeavour to press them down, and they in their turn will press still stronger downwards, but will meet with a still greater reaction from below. By means of their own power of extension they will resist all compressing forces. Rest, in a body, is not an inactive state of existence. In the state which we call rest, each body receives, in addition, its proportionate share (however small,) of the impression of those forces which set the earth in motion, and retain it in its orbit. In this way it participates, to a certain degree, in the union of those active powers which sustain the world in that motion, which is also the most perfect equilibrium. But this is not all. Each separate body, in whatever part of the universe it may exist, is affected by a number of surrounding forces, which tend to produce internal changes. An incessant alternation is maintained between it and the rest of the universe by means of heat, electricity, and magnetism. A constantly renewed giving and taking of influences is inseparable from material existence. But we should not limit our observations here. We do not know all mundane forces, but it is easy to perceive that many of those powers which act on matter, endeavour to disturb and arrest its present condition, whilst others seek to preserve it. We know, in many cases, the conditions under which substances preserve or change their state; or, on the other hand, are decomposed into their constituent parts, or are obliged to form new combinations. Can we reasonably doubt that such conditions do exist even where we are unconscious of them?

S. Certainly not: we may rather assume, that all bodies are subject to the same conditions.

A. Well; there is, then, no body, or part of a body, whose existence can be called invariable. Wherever, in the material world, anything seems to be unchanged, whether it is in reference to its situation or its internal condition, this inaction is only apparent, as the hour-hands of a clock

appear to be stationary, when we take a cursory glance at them. This is, however, but a feeble simile, when we speak of changes which are hardly perceptible in the course of many thousand years. Imagine a clock with a hand which took ten thousand years to pass over the space which the hour-hand does in one hour, and the simile will be more expressive.

S. I confess I feel myself not only unable to contradict you, but nearly convinced of the justice of your argument; but now I think you must show us the Invariable, which, as you yourself say, reveals itself in existence.

A. You mentioned to-day in our walk, that you had twice visited the waterfall of Sarpen, in Norway; did you each time see the same water?

S. Certainly not. The water rushes down with furious impetuosity, and is constantly replaced by a fresh supply.

A. And yet it was the same waterfall that you saw both times.

S. I understand you. The material parts were not the invariable. But now assist me in naming what is the invariable in it, as I cannot at this moment express it.

A. In the first place we may say that the invariable consists in a number of effects, which always remain essentially the same. You here receive an impression of the fall of a great mass of water, which every time comes from the same enormous height, and always encounters the same obstacles. The dispersion of the drops, the foam, the sound occasioned by the fall as well as by the roaring and foaming of the water, which always arise from the same causes, ever remain the same. In the impression which all these things produce upon us we feel a variety, but at the same time a totality; or in other words, we feel the variety of the single impressions as the effect of one great action of nature produced by the peculiar conditions of the locality. Perhaps the invariable in this phenomenon might be superficially termed the thought of nature inherent to it.

S. You mean by that, the thought which we connect with it?

A. Let us be satisfied with that at present; I have not yet earned the right to assert more.

S. Will you ever be able to obtain such a right?

A. I shall endeavour to do so, with your approval. You

have already acknowledged that nothing material can be called invariable.

S. And I will not withdraw my assent.

A. Whereas the laws of nature are constant.

S. That is everywhere acknowledged; but how does that agree with what I have heard and read, that the earth, before it was in its present condition, produced a different race of animals and plants?

A. If we follow the same principles under different circumstances, must not the actions themselves differ, and will they not do so in a still higher degree, the more completely the principles are developed and understood?

S. This must indeed be true, for when following a particular principle of education, we feel ourselves obliged to treat an older child differently from a younger one, a sick child differently from a healthy one, the active differently from the idle. I understand you now. You mean that the animal and vegetable creations of a former world were brought forth according to the same laws of nature, but not under the same circumstances.

A. Such is the case. The earth which appears neither to have become warmer nor colder since man was created, presents indisputable proofs, from the remains of still older inhabitants, that in an earlier age of developement it was warmer, had a more humid atmosphere, and was covered to a greater extent with sea; and notwithstanding all these discrepancies, the animal and vegetable kingdoms of that period bear so strong a resemblance to our own, that they appear but different emanations from the same great Thought.

S. But are not the different conditions which then existed, a proof that nature was formerly governed by other laws?

A. If it is one of the principles of nature that everything develops itself in the course of time, different conditions must necessarily succeed one another, or I would rather say, proceed out of one another; otherwise the connection would be wanting. We will select one great example. As our earth has gradually developed itself, so also have all the other planets. But is it probable that they were all formed at the same time? And if they were, (which we must however deny,) can we believe that those planets which are very distant from the sun, and which require many years to complete their orbits, would be developed in the same manner,

The laws of nature are constant

The same laws

*Similarity of laws
different circumstances*

and in the same space of time, as those which approach the sun, or would there not rather arise great differences from the similarity of the laws acting under such dissimilar conditions?

S. I acknowledge the invalidity of my objection. But how do you proceed?

A. The next proposition which I shall appeal to, is to this purport,—the laws of nature are founded on Reason.—

S. Do you found this upon the divine wisdom which is revealed in nature?

A. I would, if I could venture to build upon my own convictions, but I have too great a dread of self-deception, by which so many have been already deceived. *Reason—foundation of nature*

S. But how will you then prove your proposition?

A. By a great fact in the history of science.

H. By a fact! That is indeed wonderful.

A. Yes, by a fact, or rather a collection of facts, which reveals the connection that subsists between nature and our minds.

H. Let us hear it.

A. Naturalists have frequently deduced natural laws from a process of reasoning, and afterwards discovered them really existing in nature. *Nature philosophy*

H. I thought that we could hardly ever arrive at natural laws by a purely speculative path, since they must be confirmed by experience. *an a priori reasoning*

A. We are at least not yet prepared to deduce the natural laws from the highest source of all knowledge. But that is not now the question. I am here considering the manner in which scientific men usually proceed. They direct their attention to such objects as are most familiar to us, and which are at the same time beacon-lights in the entire range of our knowledge; and they search for laws to account for them. Thus the remarkable laws of uniformly-increasing velocity have been deduced from the nature of motion. From the nature of space, the law has been deduced that an effect proceeding from one point becomes weaker in proportion as the square of the distance increases. These two conclusions, and the idea that all bodies at equal distances equally attract one another, are almost the only sources from which the doctrine of the planetary laws of motion—this great mechanism of the heavens—has been derived. *of nature*

H. But were they not essentially supported by experience?

A. Certainly! We should hardly have discovered all that is at present known of the motion of the heavenly bodies, if we had not been led to it by experience; but afterwards, in the mechanism of the heavens, one truth was elicited from another, without deriving more from experience than some individual points of connection. This deduction of truth arose from indisputable conclusions; and experience has confirmed many peculiar laws of nature, which have been thus discovered.

H. But are there such examples in other sciences besides astronomy?

A. Many, although none on so grand a scale. The properties of light are so connected that they may generally be deduced from one another; and although we start from separate points of experience, any one acquainted with science is aware that most facts are united by the undoubted conclusions of Reason, so that we can almost everywhere calculate from the known to the unknown, and thence draw conclusions, and afterwards find our discoveries again confirmed by experience. We do not indeed always obtain this satisfaction; but that which we encounter of an unsatisfactory nature will disappear with a further developement of knowledge, as has happened to many defects which have been removed in the course of the last two centuries.

H. Such examples surely are only met with in mathematical sciences.

A. And even if it were so, it would be sufficient for my purpose, for mathematics and its application to nature is certainly an act of Reason. Moreover mathematics must be an element of all perfect knowledge; since we cannot possibly comprehend anything essentially without knowing its magnitudes and proportions. Even the simplest knowledge contains a natural mathematics dwelling in every reasoning mind; but the predictions which we have mentioned here are by no means limited to the science of mathematics. I need only remind you of the celebrated discoveries of the lightning conductor, the air balloon, the voltaic battery, and the metallic bases of the earths. It is well known that they were not brought to light by chance, for although the last was casually discovered, it had been long prophesied by Lavoisier. I may also add, that each of these discoveries in

itself has again often given a spur to anticipations which have been afterwards justified by experience. We may here apply Schiller's words, and say, "What the Spirit promises Nature performs."*

H. But it frequently happens that nature does not corroborate the conclusions at which man arrives.

A. That is certainly the case, but we always discover where the mistake lies; indeed, I maintain we can never fail in so doing if we are able to survey the passage from error to truth.

H. This applies to the speculative sciences, and indeed must necessarily do so.

A. You will say that I have here spoken what is self-evident, a tautology which expresses nothing, but if so, you have only attended to a passing impression, as so often happens in the course of conversation; otherwise you would have easily perceived how much stress was laid upon the idea that our reason does not only test the work of our own reason, but that we here test the agreement of our reason with a work which we are certain our reason did not produce.

H. Is this certain? Is it not possible that what we consider as something totally separate from ourselves, is only the effect of an active power at work in our own minds, of which we are unconscious?

Ideal
is -

A. So you are an Idealist?

H. At this moment I am one, in opposition to your dualistic assertion.

A. You, therefore, suppose, that I conceive our understanding is such as to believe that the Internal and External which meet there, are two different things; you will presently see how much you mistake me. We are conscious, that in the arrangement of the exterior world, there is something which is quite independent of our mode of comprehension. The world began its path of creation before man existed, and many times does its course run counter to our preconceived ideas. You would hear no contradictions from me, if your thought produced mine.

the world is

H. Do we not often contradict ourselves in our dreamy imaginations?

A. True; but if you wished to follow out this idea in earnest, you would convert our whole existence into a dream, and I, at least, would decline continuing this dream.

* Was der Geist verspricht leistet die Natur.

H. Well, I myself did not wish to pursue this unnatural train of thought, but you cannot deny, that what we discern in the laws of nature is our own Reason. Am I not justified in the idea, that in the outer world there is something that ~~makes an impression upon us, but which may be quite differently constituted from what we imagine it to be;~~ and that what we call natural laws, are only in reality the laws of our own mode of perception?

A. I must separate two points which are included in your question: the one is what in our sensational* perceptions constitutes sensibility, the feeling which is roused in us by external objects; the other is that which, by the united comprehension of our senses and our reason, we learn to know of the reciprocal effect of one thing upon another. That sensation is not the same in all sentient beings, although influenced by similar exterior causes, we have already learnt by that which we have imparted to one another about these impressions, as well as by the comparison of our own impressions in different circumstances. An illness has power to alter the transparent part of the eye, so that everything is seen through a yellow medium, but, as the illness departs, the natural perception of colour returns again. There are some who cannot distinguish between red and blue, although, in other respects, they see correctly. How much greater must be the variety, if we imagine the inhabitants of another globe, whose organs of sense are probably constructed on an entirely different plan.

H. You seem inclined to grant all that I require.

A. By no means, if I have rightly understood you. The reciprocal impression of one thing upon another, reveals much that cannot depend upon our natural perceptions. Suppose, for instance, I put some grains of salt into one glass of water, and some grains of gold into another, the salt vanishes before my eyes and unites with the water, but the grains of gold remain as they were at first. Is it possible, that a being with differently constructed senses, could see the opposite effect? Could he see the grains of gold dissolve in the water, and the grains of salt remain unaltered? A being endowed with finer senses, might continue to distinguish, in the

* We have adopted the term sensationalism from Mr. Morell's History of the Speculative Philosophy of Europe, as a truer explanation of the German word *Sinnlichkeit* than the usual word Sensuality.—Tr.

solution, between the particles of salt and water, when our eyes, even though mechanically assisted, might not detect a single grain: on the other hand, failing in the sense of colour, he might be unable to distinguish the coloured gold from the colourless salt; but the law that water absorbs salt and leaves gold untouched, must remain the same to such a being ~~as much as to ourselves.~~

F. I think that Hermann will allow this is an important example.

A. Still it is not sufficient to explain the matter fully. Let us suppose that an inhabitant of the planet Jupiter were able to come to us, and saw two stones fall, one from the height of sixty feet, the other from fifteen feet, would he not see as clearly as we do, that the first takes twice as long to fall as the second?

S. Are you not mistaken when you say, the stone which fell sixty feet only took twice as long to fall as that which fell fifteen feet? I should have thought it would have taken four times as long.

A.. What I said appears at first sight wrong, but it is not so in reality. The stone which continues to fall, after it has passed fifteen feet, has already received a considerable velocity, which enables it to pass through the remainder of its way much quicker than it would have done, if it had begun to fall during the latter portion of the way. By strict calculation it can be proved, that a body falls four times in two seconds, nine times in three seconds, sixteen times in four seconds, as far as it did in the first second.

S. I must, therefore, multiply the seconds into themselves, twice two, three times three, four times four, in order to find out the space which has been traversed?

A. Exactly so. I selected this somewhat difficult example, in order to point out, that we frequently find the reasonable laws of nature have been followed, where, before we had thoroughly investigated the subject, we should have considered the occurrence a contradiction of reason. This alone ought to incline us to seek the cause without, and not within our being; but I perceive that our friend would oppose this assertion of mine, by observing that objects follow laws of our nature which are unknown to the very nature itself. At all events, I require him to conclude our metaphysical experiment by declaring whether he is not also of opinion,

that our visitor from Jupiter must find one of the two periods twice as long as the other.

H. This question would fall to the ground, if time and space were not sensible forms to him, as they are to us.

A. And still more so if his reason obeyed different laws from ours.

H. No, there exists but one reason. It may be more or less ~~impeded by sensationalism, but reason in one planet is essentially the same as in another.~~

A. But surely our inhabitant of Jupiter cannot be a purely rational being, and at the same time definite.

H. Certainly not.

A. But if the relation which is founded on reasonable grounds between cause and effect, between a mental action and its repetition, between one thing and another, and between more and less, really exists, and reveals itself in a finite manner, there must be a form in which this comes to pass. I do not, therefore, see how we can escape the inference, that space and time are necessary forms of the Finite; necessary forms of sense, categories of the Finite, if we may call them by such terms. But even if we should attempt to conceive different forms of the Finite, there must be something in them which answers to the laws of reason, and hence would arise a close connection between the impressions which the same thing will produce on an inhabitant of Jupiter and an inhabitant of this earth. In the mean time, I believe that this semi-evasion, which is neither a complete retreat for myself nor my opponent, will be removed in the end.

H. I should like to see this effected.

A. If I premise that my experience is not merely the production of the mental activity of my own nature; in other words, not merely a dream, in which you are my vision as I am yours, but in which the external as well as the internal has its share in my experience, then everything that is alike in our experience must bear a corresponding similitude in external circumstances.

H. But beyond that, Reality may be very different from what we imagine it to be.

A. I require no more. Let us only cite a few examples, not as a proof, but in order that we may with greater facility reach a more comprehensive truth. I therefore observe, in

the first place, that we find the same laws in all the planets. They each of them enjoy day and night by revolving on their axis, and have years through their revolution round the sun. Those planets which have moons are encircled by them in conformity with the same laws which regulate our earth and moon, and these laws are again the same as those obeyed by every object on the surface of our earth. The manner in which the planets are illuminated and reflect their borrowed light on us, is the same as we observe in terrestrial bodies. Only consider that in the powerful light which we receive from all parts of the universe, we cannot perceive any essential effect which may not be referred to the very same laws to which our terrestrial light is subjected.

H. Well, I do not think that you need proceed further; neither I, nor any one else, can easily deny that everything (so far as our powers of comprehension reach) is subject to the same laws; but consider that perhaps it is the nature of our faculties which creates these laws.

A. But you must not forget that a resemblance must exist between objects which operate alike upon similarly constituted beings.

H. And suppose I should grant this?

A. The natural consequence would be that all other planets must bear a close resemblance to our earth in their properties and laws, as we have comprehended and developed them with the same powers which we use in the examination of earthly things, and that the beings inhabiting them cannot be so essentially different from us that we need suppose it necessary to seek in them for an imaginary and entirely different species of being from ourselves, with a different apprehension of time and space.

F. Both your ideas, my friends, appear to me very unnatural. Were we to seek everything in our powers of apprehension alone, no community between man and man could subsist; each would be a world for himself; even if we admitted that an outward and entirely independent world contributes to our experience, it would still be incomprehensible were we to meet only with a system of laws. If we were not able to understand the nature of independent objects, we should be forced to acknowledge them by the continual interruption of those laws which our reason requires. To seek for the source of our experience only out of our-

Against materialism

18 ✓
 the laws of our reason
 the laws of nature
 both human and nature - be
 leading
 selves is, we are aware, equally vain. Are we not following very impracticable paths?

A. I see the same difficulties as you do, but I thought it better to let them be expressed in words: besides, they appear to vanish, if we admit that the world, and the human mind, were created according to the same laws. If the laws of our reason did not exist in Nature, we should vainly attempt to force them upon her; if the laws of nature did not exist in our reason, we should not be able to comprehend them.

F. It is true that the above-mentioned difficulties are thus removed, but this preconceived Harmony appears to me unnatural.

A. If that word has the same signification here as in the history of philosophy, I must guard myself against it; but in the meanwhile I maintain that a Harmony does here exist, for man is a production of Nature, therefore the same laws must rule in both.

F. The only thing that offends me here, is to be obliged to regard man as a mere production of nature.

A. I cannot express myself differently, unless I were to interrupt the whole course of the ideas we have hitherto pursued, but in our researches I have acquired the right to say, that our spiritual nature and the world were both created by God, and it will thus appear that both propositions denote the same thing, only in different ways.

F. But are not the difficulties best removed by those who start from the Idea of God, the original Reasoner and Designer of all things, and who conceive the universe to be his thoughts? We then are self-animated, self-conscious thoughts of the divinity, imbued from our birth with the divine thought which lies concealed in the unconscious departments of nature.

A. This appears to me the truth, when viewed from the side whence we seek the source of existence in the thinking principle; but every direction by which we reach the truth, only shows it us on one side. If we give precedence to the thinking principle, the image which we form of the external world becomes faint and shadowy, somewhat like a landscape hidden by a cloud; if we begin with the sensible world, our freedom retreats too far back. We must approach truth from more than one side in order to comprehend it

in that totality and completeness which it is possible for us to reach.

F. But you seem to lay too much stress upon the external world. Let it appear to us as a shadow, and the spirit will see it in its true bearing; let it lie before us in a cloud of light, and we shall be reminded that its light is borrowed from the world of soul. Or, not to speak in metaphors, what can we learn from irrational existence, which is not to be found in our own rational inner nature? And further, I must ask, what can the living soul learn from soulless nature? Shall life go to school with death?

A. Alas! if it is not so.

F. You certainly misunderstand me.

A. Pardon me, if I have intentionally allowed the conversation to become somewhat involved, in order to prolong your eloquent attack. In the meanwhile it is my real opinion that our understanding is wrongly constituted, if our living spirit does not learn something from Nature, by us ~~called~~ lifeless. That very freedom which is the highest privilege of our Reason carries with it the possibility of erring; and the profound depth, which leaves there so much to be discovered, causes it to be to a certain degree a riddle to itself, which not unfrequently misleads it. The Reason which is manifest in involuntary nature is of itself infallible, and in general is less easily misunderstood. How much man is inclined to consider himself the centre of everything! The heavens must turn round him alone; the stars must foretell his fate; for him the whole is created. Do you believe that man would have relinquished these ideas without a study of nature? or do you suppose that a theory of the world with which these ideas are intermingled would ever have become clear and distinct? Man is naturally inclined to ascribe to spirits with human passions events which are beyond his power of comprehension, or he attributes to God himself human intentions. Does not natural science banish such conceptions of the arbitrary arrangements of the Divinity, which have too often defiled religion itself?

F. Have there never been any reasoning minds who have relinquished such ideas without the aid of natural science?

A. Certainly, but very few; and I should suppose it only occurred because, turning away from nature, they gave her

but little of their attention, and absorbed themselves in their own thoughts.

F. Consequently the others were led wrong by their observations of nature.

A. Do not say "by their observation of Nature;" for it was the rough impression of Nature which led them wrong, and not a scientific knowledge of it. Besides, the view of the world taken by the best philosophers, has been prejudiced by their want of natural science. No proof is necessary to show that a contemplation of the world is a fundamental element of philosophy, but it is no less certain that this must be either fruitless, or in many respects false, if it does not possess in itself the most essential truths enjoined by nature. Even if the philosophers of the present day are not unacquainted with the results of the natural sciences, they generally pay so little attention to them, that it exercises little influence in their inquiries.

F. So it appears to me; but we ought to return to our subject. Has Sophia anything else to ask on what we have just been discussing?

S. Nothing of importance; though indeed I had one question on my lips when the conversation took the last turn. When you alluded to the idea, that the Reason manifested in Nature is infallible, while ours is fallible, should you not rather have said, that our Reason accords with that of Nature, as that in the voice of Nature with ours?

A. Each of these interpretations may be justified by the idea to which it applies, whether we start from ourselves or from external nature. There are yet other ways of expressing it; for instance, the laws of Nature are the thoughts of Nature.

S. Then these thoughts of Nature are also thoughts of God.

A. Undoubtedly so, but however valuable the expression may be, I would rather that we should not make use of it till we are convinced that our investigation leads to a view of Nature, which is also the contemplation of God. We shall then feel justified by a different and more perfect knowledge to call the thoughts of Nature those of God; I therefore beg you will not proceed so fast.

S. Willingly, for I feel most strongly that we are still distant from our goal. Among other things, I wish to ask you

whether these thoughts of Nature are, like ours, reciprocally connected?

A. This is an important question, and we must go through a series of considerations that we may arrive at a correct answer.

S. Will it be in the affirmative?

A. As certainly as Nature is an entire and not an imperfect work. The first step in our investigation will be, to convince us that the laws of Nature, by which every individual thing is governed, not only forms a variety but a totality, a unity, and a whole. Would it fatigue you, if we were to repeat once more what we said about the waterfall of Sarpen, ^{to tell} in order to point out this inward and necessary unity?

S. I assure you that such momentous considerations never tire me, if I can only comprehend what they mean. ^{in Nature}

A. The fundamental idea, so far as a fundamental idea can be expressed in such a natural object, is a river falling from a height. The water constantly renewed by the incessant stream, falls from a considerable elevation. It obeys the same laws of falling as all other bodies, and thus, during its fall, receives an ever-increasing velocity. As water, the parts naturally roll over one another and disperse, and thus form separate floating drops. By the constant increase in the velocity, the parts which first fell gain a start, which again separates them from those that follow, and this causes a violent dispersion; every obstacle scatters innumerable drops in all directions; if I may so express myself, a world of moving drops is created, which, in spite of all the changing circumstances around them, still preserve a degree of individuality. The air mingling with the rushing water, makes foam, which is composed of numerous air-bubbles, surrounded by little skins of water, whose remarkable ever-varying and irregular white surface is well known. The height of the tone produced by each individual part, is determined by the height of the fall, but its force is not only decided by that, but also by the number of the falling parts. The impression which the united sound produces may indeed, in some degree, vary, but it always remains essentially the same. The noisy roar of the foaming fall testifies its destructive power, which appears when anything fragile comes in its way. All this, as well as much that I may have forgotten, and still more which occurs unknown to me, forms

a most intimately connected whole, in which each individual part is formed according to the laws of nature, or, in other words, all the thoughts of nature which it contains are inseparable from the primary idea. Its distinguishing peculiarity among other waterfalls, arises from its natural situation which is quite peculiar to it. The various changes which this phenomenon assumes, in spite of its individual peculiarity, are derived from changes in external circumstances; differences in the velocity of the falling stream, in its direction and power, the light, the movement of the atmosphere, the heat, &c. Thus it stands before us in its peculiar character, almost like an animated being, filling our imaginations with the image of a powerful although an unconscious giant, a slave of nature, with almost unbridled power.

S. All this seems very clear, but it is very horrible. I feel almost more dizzy when looking into the empty nothingness of existence, which you unfold before my eyes, than if I looked down into the deep gulf of water.

A. But you would not wish to remain here forsaken, nor do you believe that I should leave you in this waste.

S. Then pray come to my assistance.

A. My assistance will principally consist in this, that I shall encourage you to help yourself. It was undoubtedly the apparent unsubstantiality of the object we were considering which alarmed you, but reflect that, without a knowledge of science, you must have regarded the same object as equally unsubstantial.

S. I see you are right, but I feared that every other existing object might in the same way be resolved into mere thought.

A. Not into mere thought; for all existing objects are active forces of nature, which represent to us a unity of thought; the grounds of your fear lay elsewhere.

S. I believe so, but tell me where?

A. The unity of thought here is not represented to us as a small and exclusive world of thought, but as a fragment of a greater unity of thought.

S. Yes, I believe that is the case.

A. But you must expect to find something similar to this, if not in the same degree, in every existing thing, since every object which is not complete in itself is only a part of the great whole.

unity of thought

in object

S. But I fear the substantiality of objects will thus disappear.

A. Your anxiety ~~is not~~ without a cause; and yet, if we continue our reflections I do not fear for you.

S. You have great confidence in me.

A. I must banish fear from our reflections to its true home.

S. Where does it lie?

A. In existence itself. Take any individual object you please from the whole and survey it thoroughly, and you will everywhere meet with dependence and mortality. This complaint is, as you know, as old as the race of man; if there is anything imperishable, it will not be found in the material portion of existence.

S. I perceive that I was heedlessly on the point of requiring what was impossible. But you must pardon me.

A. I should not have thought of it, had I not feared you might be tempted to reproach us for our investigations, and say that the view of existence we have taken is less powerful and lively than it really is. We must have it deeply impressed upon us, that every question bearing on the Invariable in nature, if we do not raise ourselves above the standard of sensible existence, is apt to lead to a desponding feeling of nothingness. We therefore only discover the Invariable by means of conclusions founded on reason. 12

S. But what is to become of him who does not know how to make a reasonable conclusion?

A. He is supported by the light of Reason which religion bestows.

S. That is true; and now let us proceed.

A. I will now try to give some little idea of those views which we must next endeavour to appropriate. We are all agreed that, except the fundamental forces in Nature, the ~~creating forces, there is nothing constant but those laws by which everything is regulated, and that these Laws in Nature may justly be called the Thoughts of Nature.~~ The fundamental forces themselves exist in all bodies; their difference only depends upon the natural laws by which they are governed. That from which an object derives its enduring peculiarity, its peculiar essence, is, therefore, as we have already admitted, ~~that combination of Nature's laws by which it was produced and is sustained.~~ But the Laws of Nature are the Thoughts of Nature, and the essence of things depends upon the Thoughts that are expressed in them. In so far as

peculiarities

any thing is said to be a distinct essence, all the Thoughts of Nature expressed in it must combine in one essential Thought, which we call the Idea of the thing. The essence of a thing is therefore its living Idea.

S. Then the essence of a thing becomes a mere thought.

A. Do not let us forget that I said its *living* idea, and I mean by that the idea realized by the forces of nature.

S. But I have so often heard and read that the idea can never be realized.

A. In the strictest sense of the word this is perfectly true. In each individual the idea is only realized in certain directions and with certain peculiar distinctions. This also happens in Art. The sculptor never attempts to represent in a statue the idea of the complete man, but in every individual work he represents him with some one prominent feature; Jupiter with power and substantiality; Apollo with youthful animation and inspiration; Venus with the charms of loveliness, Minerva with the stamp of power and thought, but united to maidenly dignity. Do not believe that what I have said has nearly exhausted the subject. I only wish to point out that an idea, or if you will, a fundamental idea, may adopt various peculiar forms, which we may regard as the expressions of many ideas more accurately defined.

S. But are ideas as perfectly realized in nature as in Art?

A. If we consider the collected works of the artist as a world of Art, I may venture to say that the world of Nature is not inferior to it; but we will not draw the comparison too closely. Nature executes all her Ideas with unnumbered variations, and in works whose production occupies an immeasurable space of time. The complete idea is expressed in the totality of all things. As a philosopher brings out one idea in the most varied forms, or as a musician does so when he makes variations to a theme, so does Nature, though with still greater variety. Each individual is thus a peculiar realization of the fundamental Idea of the thing. But fertile Nature does not limit herself to exhibit performances of which the ideas are isolated; she appears to us in innumerable alternations of finite relations, which a prejudiced observer would designate as the most manifest imperfection, but which must appear to one who follows out the course of

nature to the highest point to which it should be developed in the human race, as separate acts by which the ideas of objects are revealed in their whole force to a powerful and penetrating understanding. But also in the present state of things, where even the most powerful intellect has not reached such a height, the scientific man may gain the same insight, though by a less wearisome path.

S. Your views are now perfectly clear; but allow me to put one more question, which occurred to me before, though I did not like to interrupt your conversation. You said that the peculiarity of things only depended upon laws in Nature, but from my own experience, the material which composes the thing induces also varieties; the rose, as I have heard, receives its smell from an oil in the plant, the grapes their taste from the sugar and different acids they contain, and you are better acquainted than I am with innumerable examples of a similar kind.

A. All these materials are only ^{reductions} combinations of more simple materials, and their union is the result of natural laws. At the same time, you touched there on a point which might entangle us in researches which have not yet been solved. Allow me, therefore, to point out how science has shown the same elements to exist in very different plants, and parts of plants, so that poisonous plants, and those which afford us nourishment, do not receive their essential qualities from the elements out of which they are composed, but from the manner in which these elements are arranged, ^{i. e.} by the natural thoughts, which in them are realized.

S. By this means this doubt is removed.

A. All things are accordingly realized ideas, but each idea is expressed in a very limited form, whereas, when a number of natural occurrences happen under one idea, it becomes most completely realized; meanwhile, every idea in the finite world, which is realized in this manner, is again only a part of a higher and more enlarged idea. Therefore, the idea of each species of animal is only a part of the idea of the whole animal kingdom, and this again only a part of a still more enlarged idea, which comprises in itself both the animal and vegetable kingdom; this again is a part of the whole idea of the earth, which appears to us as an exclusive little world in itself, but, notwithstanding, is only a part of a still higher system.

Peculiarities of laws of
 nature
 not yet solved
 made by

H. But is this connection a reality, or only a conception of our own brain?

A. Nature herself shows us that it is her work. Our researches, with respect to the formation of the earth, have taught us, as I have already said, that it has been developed in a long period of time; that at each new stage of development, new kinds of plants and animals were formed, which as much resembled in structure and form the productions of the present period of the earth, as different realizations of the same fundamental Idea must resemble one another. It is besides of great importance to consider the progress of its development. Nature commenced with the lowest organized animals and plants, and ascended by degrees through successive periods to higher forms, which, at the same time, constituted in the earlier formations, a less highly developed kingdom of creation than what now covers the surface of the earth. We must also add, that the higher species of animals in their embryo condition, proceed from lower stages of development, which are connected with those on which the inferior animals remain, and thence they traverse successive stages before they reach the end they were intended for.

H. You need say no more; I acknowledge the importance of your principles.

A. I shall, therefore, continue to build upon what you have conceded. Our globe is a part of our solar system, with which it has developed itself, and is in constant reciprocal action. The idea of the globe is consequently included in that of the solar system, but in the same way this is again a part of the system above it, that system of suns, revealed to us by the milky way, and in which, by means of our ingenious optical instruments, and the inferences we have drawn from the laws of Nature, we have been enabled to behold what must always remain hidden to the unassisted senses of men. This system, which appears so enormous to us, is a part of a more distant and higher system, and thus it continues through unbounded space. Even so an eternal Whole is created in infinite space, which embraces all the ideas realized in existence; but this infinity of ideas is, at the same time, included in one operating idea, in an infinite living reason.

H. I can now trust myself to predict the answer which you will give to the question which was the cause of our con-

versation. The material and the spiritual are inseparably united in the living idea of the Almighty Power by whom all things are created.

S. But, according to this view, man appears to be only the most distinguished among the animals, not a free agent, nor a reasonable being.

A. It may appear so at first sight, but we must consider that man is distinguished above all other creatures on earth by this; viz., that Reason, which all other animals unconsciously obey, in him is awakened into self-consciousness. He is thus a free agent; but remember, only so far as is possible to a finite being.

S. But I still encounter another fearful difficulty; I do not see how our immortality is thus secured.

A. You will meet with no system in which immortality is proved. In each it must be left to faith, as it is here; but if you ask how this faith can be reconciled with our views, and can be justified by them, I limit myself to the answer, that, in my opinion, this may be effected here, at least as strongly, if not in a more satisfactory manner, than in any other system; but it requires separate investigation, which must be reserved for another occasion.

THE FOUNTAIN.

A CONVERSATION.

WHEN I first went to Paris I used often to visit the Tuileries Gardens, and sit down opposite two beautiful fountains. Since that time I have been frequently reminded of the impression they made on me, and the following conversation has been the result, which was not however committed to paper till a much later period, about eight years ago. When I last visited Paris, in the year 1846, these fountains were replaced by others, constructed on a greater scale and far more splendid, they also produced more sound, and were perhaps better adapted to the busy throng, but on that account less welcome to the traveller, who, seeking rest, desires to yield himself to the impressions of nature in one of its most pleasing forms.

ALFRED. FRANK.

ALFRED. We have wandered about long enough for so warm a day. Let us sit down upon this bench, under these blossoming lime trees. The delicious fragrance, the cool shade, the lofty fountain opposite; every thing invites us. To me this is one of the most beautiful spots in the garden.

FRANK. I quite agree with your taste; it is my favourite haunt. I often sit here for a long time, yielding myself to the impression of surrounding nature. If any one happened to notice me he would think I was lost in thought, and yet I often discover that I am in a condition of which it may be most correctly said, I am thinking of nothing at all. At the same time this state is by no means one of inaction. I might feel myself tempted to call it dream-like; but it neither resembles dreams in their disconnected ideas, nor in their complete abstraction from the remaining portion of our consciousness. I feel as if nature spoke to me with a thousand tongues, and I were her quiet and self-absorbed listener. This is far from being an unprofitable state of mind, it not only is accompanied by a feeling of repose, thereby bestowing energy for fresh activity, but I often perceive that

more recollections remain with me than I at first imagined; they may, perhaps, slumber for a time, but wake in my meditations and thoughts when I require them, and surprise me like benevolent friends of whose existence I had not dreamt. Now, as your science teaches you how to penetrate the secrets of nature; can you explain this remarkable influence?

A. The spot is inviting, and I am delighted to converse with you on this subject; but there was something in your challenge which makes me fear that our conversation will not be worthy of the tone of mind which the scene demands.

F. You seem to treat the matter too seriously.

A. No indeed. I am speaking with deliberation; but you shall decide whether we should not spend our time better, if we each yielded ourselves silently to our own impressions, instead of carrying on a conversation, at the end of which we neither of us might know the real opinion of the other.

F. Can conversation have no better result?

A. Yes, certainly, provided we first clear away a certain misunderstanding.

F. I beg you will do so.

A. Permit me then to say there is a little irony in your challenge.

F. Do you think so?

A. I am persuaded that you think the desired explanation impossible, and if we allow your view of the case to be correct I grant you to be so far in the right.

F. Let us hear how much you know of my opinion.

A. You have to a certain degree imparted it to me yourself. I have observed on former occasions, that when you ask for a scientific explanation, you require the subject to be so entirely sublimated into thoughts, that no metaphysician could go further.

F. I may be permitted to remark that the Poet may be also a Metaphysician. If I am to hear an explanation I require that it should be thoroughly sifted.

A. I will not dispute this point, but I cannot undertake to give such an explanation.

F. That means that you can give none at all.

A. Well, we will not quarrel about words. I do not wish that what my science has to say upon our subject should be called an explanation, but if from this you imagine that I consider science can bring forward nothing to throw a light

upon it, I must guard myself against such a misinterpretation.

F. Well, I must not attribute to you more than justly belongs to you.

A. You must, therefore, confess that had this misunderstanding been allowed to remain, our conversation would have become a reciprocal war of words. Whatever I might have alleged, would, from your pre-judgment, have been considered without a purpose, and foreign to the matter; and you would have endeavoured to cure me of a conceit which I had never entertained. In this manner I frequently observe long conversations pass away utterly without result, which, had they been pursued by the very same men with a more favourable commencement, might have created real intellectual enjoyment.

F. I cannot deny this, but I confess I have almost forgotten what we were going to talk about.

A. I think I shall be able to point out that a frequent connection subsists between the active operations of Nature and the impressions they produce on us. But I would rather not define too accurately what I am going to say; listen with indulgence to what I bring forward; test it; and then, if necessary, we can consider the most suitable terms in which to express it.

F. I perceive you arm yourself against me, as if I were a formidable enemy.

A. You cease to be so, if you do not expect an attack from me, and if you are convinced that science, when rightly understood, assimilates with poetry.

F. Well then, let us come to the point.

A. When I behold this forcible jet of water almost as thick as a man's arm, and rising nearly 36 feet high, I am secretly impressed with the idea of a power which compels the water to ascend contrary to its gravity.

F. Permit me to interrupt you for a moment. I have frequently enjoyed the sight of this fountain without thinking of this power.

A. You are right not to let me proceed if you do not understand me. But you will perhaps withdraw your objection when you remember that I spoke of a secret impression.

F. But if the impression is secret, I can know nothing about it, and to me therefore it does not exist.

Impressed power

A. I assure you, this assertion is only a passing idea; you have continually received similar secret impressions. It is not long since we both witnessed two expert fencers engaged in a mock fight. One of them especially won our applause. Did we then calculate the amount of strength and skill which enabled him to handle his weapons so dexterously, and to assume those nimble postures by which he principally showed the complete subjection of his body to his will? Surely both the strength which he actually put forth, as well as that more passively displayed in his whole frame, contributed to our pleasure, not because we remarked to each other their unusual proportions, but because we were inwardly filled with remembrances, which roused by this sight, permitted us to feel how much power was here manifested.

F. You are perfectly right. I spoke previously against my better knowledge. It just now occurs to me, that I once showed this fountain to a child, who had never seen one before, and he said, 'How can the water rise upwards here, while every where else it falls?' Thus I am persuaded that we are struck with a secret sensation of wonder at this sight.

A. Did you explain the cause to the child?

F. Yes, I had no difficulty in doing so. I told the boy the name of the lake from which the water comes. He knew it, and was aware that it is situated in high ground; I therefore had only to tell him that the water came from that lake through subterranean pipes, and was driven upwards by the pressure of the elevated mass of water.

A. I fear now that you retract the secret wonder of which you spoke.

F. You wish to lead me into temptation, but this time you shall not succeed. A secret wonder is always excited at the sight of anything uncommon, although on a closer examination we may detect the cause. Are you now satisfied?

A. Yes, we now understand each other delightfully. I therefore proceed with much more freedom, and we will first glance at the variety of motion exhibited in this fountain. What usually first attracts our attention is the increasing size of the rising jet of water. This proceeds from the portions of water during their ascent constantly declining in rapidity, and the slower stream requiring a broader space for the same quantity of water to pass through.

F. I do not quite understand you.

A. Imagine a gate, just broad enough for ten men abreast to pass through it, and suppose it was required that a thousand men thus arranged should pass through, at a regulated pace, in the space of one minute; let this afterwards be tried with half the speed, and two minutes would then be requisite for the passage; if however there was a gate by which they might still pass in the space of one minute, it must be broad enough for twenty men abreast to pass through it at once. Now imagine a succession of rings surrounding this jet, and each ring to be a gate through which the water has to pass; so much the wider must these become, as the water diminishes in velocity. The increase in thickness which the jet acquires in its ascent is consequently produced by a succession of movements in accordance with the laws of nature.

F. That is clear. This increasing size, this almost inward growth, fetters the imagination, and kindles the idea of an inward life; but in pursuing this idea we meet with another active power. The enlargement ceases by the jet of water scattering itself into innumerable drops. It seems as if we saw a countless number of small, transparent, pendent, twigs, consisting of parts which are visibly separate, yet adhering so closely to each other that it is as if an unseen agency maintained their connection. The latent active power which was at work in the connected portion of the thick jet of water seems to be here manifested in far richer variety.

A. I think you have described that very well.

F. It is for you now to point out the cause of this.

A. It has been proved by experiment, that water which flows out of a reservoir, whether it be upwards, downwards, or sideways, receives such a vibratory motion, that hence a capability is developed for the formation of drops which alter their form at regular intervals of time. For example, if in any very short space of time a drop of water should sustain a contraction upwards, which would make it somewhat flatter, in the next period of time it would be contracted in breadth, which would cause it to become longer. Nearest the outlet, all the parts run into one another, forming a connected whole; somewhat farther off, where the jet becomes less clear and transparent, they are separated, but still apparently flow together, and only at a greater distance the visible separation takes place.

F. But are we certain that all this really happens? I

cannot see, for instance, how we know that the parts which apparently run into one another, are really separated.

A. I will not detain you with an account of the discovery, and the first attempts to prove this, but only call your attention to one simple demonstration, which has been lately brought to light. It is made by pouring out water in the dark, and causing a succession of electric sparks to follow each other at very short intervals of time, when the clouded part of the jet which previously seemed connected, we now perceive to consist of drops.

F. Do electric sparks enable us to see objects with greater exactitude?

A. Certainly, in this case. For so long as a rapid succession of drops are seen in one uniform light, the eye receives new impressions before the previous ones are extinguished, on which account one impression is undistinguishable from another; now in the experiment I have just mentioned, though the time which elapses between each light is infinitely short, each impression remains long enough to form itself, and to vanish again, before a new one can interfere with it.

F. It must be said, to the credit of experimentalists, that they know very little of impossibilities. But tell me about the tendency there is to form drops when nearer the outlet of the stream.

A. I must again pass over much, which would lead us too far from our object, and only mention a few striking experiments, which in other respects belong to our subject. As musical tones are produced by vibrations from other bodies, for instance, a string, or extended skin, or the air in a pipe, so we must infer that the vibrations in drops also produce tones; and such is really the case. If a stream of water exists under circumstances which permit the ear to be held close to the jet, and if the impression is not overpowered by some extraneous noise, a very low sound is heard from the jet itself; but should the stream fall on an extended skin, or on a great metal plate, or in an empty metal basin, the tone is heard strongly enough to determine the note, and at the same time to ascertain the number of vibrations which are requisite to produce it.

F. But is it certain that the tone produced by the skin, the plate or the basin, is actually the same as that generated by the drops?

A. I will explain the case by another well-known experiment. You will doubtless have often observed that when a tuning-fork is struck, it gives a very feeble tone, which at a moderate distance is quite inaudible; but place the handle of the fork upon a table, a pane of glass, or a stiffly-stretched skin, and its power is wonderfully increased, and whatever the material may be, which supplies the strength, the tone always remains the same.

F. That is perfectly true.

A. In connexion with these experiments on running water, there is yet another which I recollect, and which deserves our attention. When we have discovered the tone of a stream of water, and when this tone is produced by very powerful vibrations in the jet and body of water, we then perceive that a great portion of the connected jet is separated into drops; indeed, when the effect is very strong, this change applies to almost the whole of that part; thus it is established, beyond doubt, that the vibrations already exist in the connected portion of the jet.

F. It is wonderful what a sum of inner life lies concealed in this fountain. But another question occurs to me; do we not hear the same tones in the splashing which accompanies the falling drops?

A. No; those are caused by the blow of the drops against the surface of the water. Some might, perhaps, wish this noise away, but he who gladly yields himself to the impression of Nature as a harmonious whole, will not share in such a feeling. The absence of noise in the falling drops would produce an uneasy sensation in him, somewhat like a body without a shadow.

F. It is a happy idea; but I must remonstrate as a practical æsthetical philosopher, for I am often annoyed by this splashing.

A. So am I, but only when I do not yield to the impression in its totality; for instance, when I am too near the object. I am convinced the landscape-gardener did not place this bench here without reflection. His feeling for nature must have told him that this fountain would make the most pleasing impression when contemplated from this position. To be so near, that the splashing is too loudly heard, that the fountain cannot be properly surveyed, and that it does not form an agreeable whole with the neighbouring objects, is very much

the same as if a picture is seen in a false light, or under surrounding influences of a disturbing nature.

F. I must allow that you are in the right.

A. But we must not consider the case only on one side. The sound which is produced carries life and activity into the whole. This sound is naturally composed of innumerable single ones, and the effect produced receives its peculiarity from the prevailing gradation among the individual parts. The various drops descending in different arches, produce a succession of regular alternations of sound. In the collected impression which we thence receive, the various disorderly impressions, though individually slumbering to us, arrange themselves, and thus contribute to give an ascendancy to the sensation of repose and peace.

F. Here we have an insight into the connection between external nature, and the impressions which it produces on us.

A. And now let us consider the paths which are pursued by the different portions of the jet. These paths follow the laws of projection. You perceive that the water is driven upwards out of the mouth of the pipe. Whenever a body begins to move freely in this direction, it would continue uninterruptedly to do so, if the force of gravity did not constantly draw it downwards. Hence the motion is forced to describe a curved line, which is known by the name of the parabola. It can be demonstrated, that this figure is the expression of an important unity of thought, and it is proved by experiment that such forms awaken in us a feeling of the Beautiful.

F. Here, however, we are not concerned with one path, but with many, which, as it seems to me, do not all describe the same figure.

A. And such is the case. By the influence of other forces on the water, deviations are produced; the resistance of the atmosphere is not without its influence, but still a middle direction remains, which does not deviate perceptibly from the parabola, and the other paths lie around, in a regular series of approaches to that form. Hence arises a greater inward variety, besides a more comprehensive unity; and in this manner the impression gains peculiar copiousness and depth of thought.

F. I must beg of you to explain this last expression more accurately.

A. Willingly, though I will now only specify the argument nearest at hand, and not repeat the whole chain of ideas, which you formerly were justified in demanding. With this proviso I reply, that the laws of nature in the external world are the same as the thoughts within ourselves. The former are the eternal thoughts which science unfolds, and by which all things are regulated, though they are unconscious of it themselves; the latter are the same eternal thoughts, but produced in ourselves. Thus, wherever a variety of natural laws co-operate under one governing unity, we find everywhere a fulness of ideas; and I maintain that our inner sense, which is constructed in conformity to the same laws, comprehends this as the Beautiful.

F. Your meaning is sufficiently clear to me, and I must not interrupt our conversation to require proofs for the assertions which you maintain. I beg you rather to give me your views on a different effect, which has just attracted my attention. It appears to me, that there is a peculiarity in the light proceeding from that jet of water; it neither resembles the light of pearls, nor that which proceeds from still water, —there is a particular kind of glitter in it.

A. This is natural to the phenomenon. While the fountain floats before our senses, in some degree as a still image, though, at the same time, the falling drops are constantly leaving their position, and are succeeded by fresh ones, the light naturally comes to us with all the tremulous motion which the reflection from incessantly changing objects must produce. I do not only mean the change of the position which the drops sustain; there are besides two other circumstances to consider,—one, which I have already mentioned, is the frequent change of form in every drop from inward vibrations, and which occurs so rapidly, that the impressions they produce are indeed undistinguishable, but which give a peculiar character to the reflected light; the other consists in this, that the series of drops are really composed of large drops, and very small intervening ones. When I spoke of the formation of drops, I did not think it necessary to mention this; however, these small drops are connected with our subject, and claim our attention. The eye thus receives a complete series of inwardly connected impressions, which in no wise resemble those produced by transparent and immovable bodies.

F. I have sometimes received similar impressions from drops when they fall from the roof after heavy rain, or in a thaw when the sun has shone on them.

A. These impressions must have some analogy, as the formation of drops obeys the same laws in this as in the other case.

F. As I require no farther explanation on this point just now, I will propose one general question. I have seen many fountains which were very different from the present one. I have seen some rush out with much greater force in proportion to their size, and disperse themselves in far finer drops, and thus lose the impression of repose in motion here so clearly expressed. A few years ago I saw another great fountain, which made a very different impression upon me. It does not at all surprise me that small ones, like everything insignificant, should make but a slight impression; I can myself fancy that a fountain on a very small scale, would excite derision similar to an unsuccessful experiment, but still the individual peculiarities of every fountain may be worth our notice.

A. Let us first consider those fountains which are ejected by a force proportionate to their mass of water. The increased action of the inward motion, and more resistance from the atmosphere, are sufficient causes for the greater dispersion which is produced, and, therefore, as you observed, you are sensible of a more forcible stamp of life and motion; they roar and foam, and almost overpower us with their force: on which account they seem to me better suited for large and populous cities, and public gardens, than for more retired situations, which harmonize with a heavier and slower stream of water.

F. What do you say to those fountains resembling this one in every essential respect, but constructed on a much larger scale?

A. I had myself an opportunity of experiencing the different impression that is produced by one of such an enormous size, for the fountain which gave rise to this feeling was, if I rightly remember, 180 feet high, and as thick as a man's body; when I stood so near that I could distinguish the individual parts; I was unable to survey the whole, at least not so as to command the entire form; and, added to this, the noise of the falling drops was so stunning, that it

deadened the impression of the smaller falling movements. We cannot, indeed, exactly distinguish these impressions, but we are, notwithstanding, sensible of their existence. More powerful and imposing than most other fountains, the impression it otherwise made on me was rather elevating than pleasing. The inward harmony was not destroyed, but obliged to succumb to a feeling of greater strength and power.

F. You are right. When viewing a powerful waterfall, the Harmonious is still less perceived, and in a stormy sea it is almost extinguished; the impression of the Great and the Sublime there rules paramount; there does, however, exist a certain degree of magnitude which is no longer beautiful.

A. Indisputably, if we take the word *beautiful* in its usual limited signification; but it seems to me, in spite of all differences, that there is a fundamental similarity between that faculty of the soul by which we comprehend the *sublime*, and that by which we comprehend what we peculiarly designate beautiful, namely, an unconscious reason in nature, which is here apparent. In my opinion, whether we have or have not arrived at a clear conviction, that reason pervades nature, yet, in proportion to the manifestation of universal harmony surrounding us, most men perceive the accordance of the impressions of nature with this hidden reason. A stormy sea, a tempest, lightning, all manifest themselves as powers, through which the unknown spirit of nature reveals itself. A wide expanse of surface, such as the vault of heaven, a great extent of ocean, a lofty chain of mountains, excite a feeling in us nearly akin to this. They appear as the works of the eternal power of nature, and arouse within us the feeling of an independent and an all-ruling Being.

F. But I have often felt very differently when in the presence of such great objects. I well remember that once, in a mountainous country, when an enormous precipice rose before me, I was overcome by a sense of desertion and death.

A. That often happens when there is nothing present to remind us powerfully of life and activity. If the feeling of the Sublime overcomes us when, standing on a barren, stony plain, we look upwards towards a huge wall of rock, it chiefly arises because our spirit, amidst innumerable recollections, suddenly awakened by other circumstances, turns towards the

power which has produced the object. This object itself does not awaken any strong feeling; and that spirit must have had a peculiar tendency and tone which would rather dwell on the Sublime than tremble before the overwhelming presence of death. It is very different when mountains rise in various forms before us; when waterfalls glitter, foam, and roar; when woods and pasture-land prove the fertility of the soil; and when birds and insects enliven the air: then Nature herself bids us turn our thoughts to the Sublime. Without a previous sense of the inner life of reason, that which might otherwise be called beautiful would be dead. That which is full of life arouses it in ourselves; and this feeling of life appertains to the complete enjoyment of beauty. What a rich variety of inward activity we beheld in that fountain; were this to be separated from it, all besides would leave but a faint impression! An attempt to represent it in painting might in some degree please the eye, if it were executed in a masterly manner; but the enjoyment which arises from the peculiar nature of the object would be much diminished, because motion, lustre, and the play of light, could never be represented in a picture. I have several times seen pictures of fountains, but the impression they produced upon me was very poor.

F. I cannot contradict you. Then you require that the Beautiful should comprehend the Sublime, the Living, and the Harmonious; but after what you have expressed about the Sublime, it appears to me this is only a peculiar quality of the Living. You particularly cited active operations as examples.

A. And great effects as well; yet I do not deny that these all point to the power which produces. In the Sublime, however, our thoughts do not dwell with the active power, but with the independence which is there revealed; this may happen in different ways, so that I consider the Sublime may be divided into many sorts; however, we will not enter on this subject, but I will merely observe that all conditions of beauty are so inwardly connected, that they always appear to us united.

F. The evening closes in, and I must leave you, as I am expected at home; but reflecting with pleasure on our conversation, I confess I am surprised by some unpleasant feelings. It seems to me as if our observations had been too material.

A. We are apt to feel this whenever we trace a connexion between our own inner life and the influences of external nature ; but does it originate from our comprehending nature in too material a manner ? It seems to me, in such cases, we forget, or rather we do not sufficiently remember, that Nature is the work of the same Spirit to whom we owe our own being. When we figure to ourselves the idea in its full reality, that it is the same reason, the same creative forces, which reveal themselves in external nature as in our own thoughts and feelings, our connection with nature must then appear as a part of the great harmony of existence, but not as a consequence of the preponderance of the Material over the Spiritual.

F. You are right. I should have known better than to make such a mistake ; our conversation comprehends enough to meet these difficulties.

THE COMPREHENSION OF NATURE

BY

THOUGHT AND IMAGINATION.

Communicated at the Meeting of Scandinavian Philosophers in
Christiania, 1844.

It is well known that man pursues very different paths in the development of his faculties, and in his apprehension of the surrounding world, and that these paths are again subdivided into various smaller ones, which are followed century after century, but without ever being sufficiently connected to render it possible for them to form an organic whole. This is the case even in those sciences which start from the most closely connected efforts. How long it was before geography and botany united to form a geography of plants, and how lately has geology become connected with geography, as well as with zoology and botany, though they all approach so nearly to one another! And is it not, therefore, natural that a much greater interval should remain uncultivated between those modes of comprehension which are under the dominion of very different faculties of the soul? By this, I mean the comprehension of nature on the one hand, by the mind, on the other, by the imagination. It is true the same active forces exist in both. That faculty of thought which enables us to apprehend surrounding nature, can as little dispense with mental perception, which is the basis of all our knowledge of the outer world, as imagination can dispense with that power of thought, which gives a form to all her creations. The different manner, however, in which they manifest themselves, cannot be mistaken; they have each their peculiar domain in which they must respectively act, and mould themselves according to their own fashion. An incompetent exercise of the imagination on questions of science, or of abstract thought on art, operates, as is well

known, with a prejudicial influence. We have many examples of this in the poetical attempts which have often been made on scientific subjects, and in the still more frequent endeavours to submit art solely to the dictates of Reason; but this has given rise to exaggerated fears in those who have felt these abuses. It is not my intention to mention here how this one-sidedness exhibits itself among the labourers in the field of science; but it is this dread of exercising reason, so frequently existing in those who have lived too exclusively in the world of their own imaginations, which I now mean to consider. This dread is by no means equally expressed in all directions by the same men; there are many, in all the social affairs of life, and in all those sciences which are most nearly connected with mankind and human events, who allow full play to thought, and the knowledge derived from it, in order that it may regulate the constant action by which their world of imagination is formed; but the insight which is gained from physical science has not been able to get the same justice at their hands in consequence of their not being so intimately acquainted with it. Therefore the greater proportion of mankind have developed, in their contemplation of the physical universe, a wonderful mixture of the knowledge of the present day, and of ideas of nature which belong chiefly to the childhood of the human race. There is much that is fabulous in this conception of nature, but we cannot dispense with it, as there is nothing which we can offer in exchange for the faculty of the imagination. Even all that it contributes to the external adornment and support of religion, or to fill the blank which we are sensible of in reference to our knowledge of higher things, belongs to a past age. Hence arises that strange dread, possessed by so many, of the results of science; a dread which threatens to destroy that world which their faith and feeling for the Beautiful, had created; thus they are consigned to a vacuity and nothingness which would indeed be fearful were it unavoidable, and the triumphant conquests of natural science which give us the purest pleasure, are for such unhappy beings no less than the dangerous approaches of a conquering foe. Their greatest desire is that this foe should be driven back, and at times they entertain some faint hopes of it, which however are repeatedly destroyed by a stronger feeling of the truth, so that in reality they dare not commit themselves to

the truth of their own existence, and therefore are happiest when able to forget this dangerous enemy.

Such being the case, the investigator of natural science considers it his duty to demonstrate how the truths which are obtained by reflection and observation of Nature, contain rich materials for the imagination; these however must be employed only on one condition; namely, that we must become as intimately acquainted with those truths as we have been with the legends of the past. It is not, however, obligatory that every one should study the laws of science, any more than that the customary education hitherto given presupposes a thorough acquaintance with the world of legends; on the contrary, naturalists must persevere in their efforts, and, indeed, with renewed ardour, to facilitate the study of the truths of natural science, and to develop the real life of nature contained in them; it is vain to clothe them in the present day with the garb of ancient poetry. The most ignorant among us, as participators in a common inheritance, have unconsciously gained a knowledge of nature very different from that contemplation of the universe co-incident with the childhood of the human race; on the other hand this does not lead to those views that are developed by a more advanced knowledge of science. In the present century, therefore, we feel more than ever the necessity of reconciling the world of reason and imagination. This reconciliation is indeed not to be effected in a moment, but must be the fruit of repeated efforts; and to contribute to them, a succession of examples will serve to prove how the intuitive, and what is nearly related to it, the prophetic view of nature, may be more exactly defined and further developed by means of the profounder knowledge which is derived from reflection.

I therefore venture to offer what follows; and I select as my object the most sublime I can conceive, which is the starry firmament. I am aware that there have been ill-timed and injudicious remarks, which have injured this subject in the estimation of many, but this shall not deter me from investigating the source of those feelings which are excited when contemplating the stars, if thought is allowed to follow its natural impulse, and is not distracted by other ideas. I perhaps may displease some, by communicating

much which is already well known; but if I am to include all I wish to say, this is unavoidable.

Let us first consider the impression produced, on a quiet night, by a clear cloudless sky. There is a universal impression in it which is felt by all men. The clearness and force of the impression, however, is not alone modified according to the different temperaments peculiar to each man, but also in proportion to the different degrees of mental culture each may have received. It is this point towards which we will principally direct our attention, but we must first take into account and lay aside that which is common to all.

We need scarcely mention the vastness of the impression which the starry heavens produce, since it is so powerful as to be felt by every one. He even who seeks no more than the gratification of his senses, and whose dawning reason is but faintly traceable in his sensational apprehensions, must acknowledge that the canopy of heaven is the grandest object he knows: this vast extent however would be dead and blank to us were it not enlivened by the innumerable host of stars. Their light comes to us with double force from the darkness of the surrounding earth, when those objects which remind us of the trivial circumstances of daily life or which are of transitory importance, and which would otherwise attract our attention on all sides, are invisible. This enlarges the scale of our ideas, and quickens our perceptions for the reception of that light which proceeds from a higher, a greater, and a less transitory world. The glorious nature of light is here wonderfully manifested; its animating and beneficial effects have in all times caused it to be the most beautiful emblem of life and virtue. Beneath the mild, clear, undazzling light of stars, which scarcely enables us to see anything around us, while, if I may so express myself, the light shines but to manifest itself, we feel as if Light, and Life, and Happiness dwelt far away above us in those distant regions, while, on the other hand, Darkness, Death, and Terror remained here on earth. This idea interpreted in one manner may be easily misunderstood; but the feeling which such a sight exercises upon the unperverted senses has nothing to do with these misconstructions.

Added to all this, we have the deep, and, we may say, tangible silence of night, by which the ear receives as faint impressions of the world beneath us, as are conveyed to the

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eye by the mild starlight. In short, ~~it is not a mere flight of the imagination which causes our devotional feelings to be excited on a starlight night, but it springs from a feeling deeply rooted in our nature.~~

How different is the impression of a moonlight night. The mild light of the moon's disk, unlike that of the sun, does not oblige us to lower our eyes, but rather draws them upwards to Heaven. At the same time, it so far overpowers the light of stars that they no longer attract our notice, and sometimes become almost invisible. Moonlight also shows just so much of earth as to prevent our entirely forgetting it; thus, Fancy and Thought, rapt in mild enthusiasm, hover indefinitely between Heaven and Earth.

Let us now consider the forms which this original view assumes in the different degrees of development of the human mind. We can easily fancy the impression of a starlight night on the mind of uncivilized man: the expansive vault, rising above the surrounding woods and mountains, embraces all that is known to him of the earth's surface. His ideas of measurement are indeed far too limited to grasp the expanse of Heaven: and yet it is the most imposing object he knows; the stars to him are only points of light, but the clearness and purity of that light is not without its influence. The contrast between the bright vault of heaven and the dark earth, the silence, and the accompanying repose of mind, are so familiar to our senses, that we are none of us strangers to the impression.

Let us now imagine a man whose powers of intellect and observation are perceptibly developed; his conception of the immensity of the heavens will have proportionately increased. He has noticed particular stars, which he again recognises, and some distinguished groups more especially attract his attention: he has watched them over distant mountain summits, and as he advanced, perceived how their remoteness to each other seemed to increase, while their distance from him remained the same; this distance must consequently be so immense, that the journey he has made can bear no comparison with it. He now therefore has a greater standard by which to take his measurements: this enlarges his conception of the extent of the heavens. He observes that all terrestrial lights grow feebler and feebler the farther they are removed from us, and at a comparatively small distance they totally disap-

pear. But the lights of heaven which he knows, are many times more distant than the farthest hills, yet remain as pure and clear as if they belonged to a different order of things. He has arrived at these conclusions by observation and reflection, but the recollection of the results follow him in those hours in which he quietly resigns himself to the great impression of nature.

We will now imagine one so far advanced as to have acquired a certain knowledge of astronomy, as much as we may suppose was the case with the Chaldeans, and the aspect of the heavens increases in magnitude and completeness. He now knows that among the lesser stars, some wander in a pre-ordained path, while others are fixed in the vault of heaven; and he knows that these, as well as the sun and moon, have a regulated course. The uninterrupted observations of successive races have led to some knowledge of the unequal distances of these wandering bodies, but we may feel sure that he does not recapitulate all the knowledge which has resulted from the enquiries of the human race, and which is in some part his own, whenever he resigns himself to the impression which the heavenly bodies produce; yet, still those discoveries are as present to his contemplation as the occurrences of every-day life are to men in general. His scale of measurement is far larger than on the former position he held; the remoteness of the moon seems to him now enormous compared to all the distances on earth, and yet very small in comparison with those of the other heavenly bodies before which the moon frequently passes, and which it conceals from our view. It will be evident to every one how the idea of the magnitude of the heavens has increased in size and in importance; and added to this, there is now the still grander idea of an order existing among the heavenly movements, which is also full of beneficial results to our earth. It is the thought of a reasonable guidance, independent of the earth; of a higher Reason manifested in accordance with the condition of human nature, though not devoid of extraneous elements. From the previous position on which we stood, imagination filled up the empty space in knowledge, by the idea that a Sun-god guided the flaming car of Day across the Heavens, that he might repose at night on the lap of Ocean. The moon traversing the vault of heaven was also deified. These ideas yield at a very early stage of astronomical science, though they linger long among

imagined that it was a god
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the multitude; and not only among the ignorant, but even with those who have received some education, which however may not have included a diligent study of the heavens. The idea on the other hand has not yet reached the unity of a divine guidance; ~~each of the wandering stars receives the name of a particular divinity endowed with earthly attributes.~~ The incalculable influence of the sun upon the earth, as well as that of the moon, which is by no means inconsiderable, easily gives rise to the thought, that by their light, as by their periodical variations, the other lights of heaven are also not without their influence on human events; and this idea must have been still more firmly grounded, because no one ever imagined that the influence of the heavens extended beyond the earth. Though the gods had a higher existence, they were still gods of the earth, and this earth was the central point of the whole. People then began to ascribe to the lesser planets an influence on the fate of individual men; thus arose Astrology, which among other human follies has been so warmly supported. It is easy to perceive how the worship of the sun, or all the heavenly bodies, suited these views; but on the other hand, much of the old fabulous lore, the remains of earlier times, could only have existed simultaneously with it, because no one ventured to open the eyes of the multitude.

The conception then entertained of the structure of the heavens must have been false and narrow; although far more comprehensive than at an earlier period. At first it was believed that the whole arch of heaven moved round the earth, and that the paths which the planets follow lay within this arch; no one ever imagined that it was not stationary. It was called the "Fortress of Heaven," the firmament which rested on firm foundations, for instance, on the highest hills; but at a later period it was observed that each of these wandering lights pursued separate paths, and were at different distances from the earth, each had its individual transparent crystal arch; and above all these arches the fixed lights of heaven were supposed to dwell, the pure empyrean, the abode of the highest Immutability. All were obliged, such was the received opinion, to move round one common axis. Thus it was believed that the wandering planets occupied seven heavens, and that the eighth was the dwelling of eternal Light, and eternal Immutability.

Although we have now left this point of view far behind us, we must yet confess that the soul which drew nourishment from this knowledge received a more comprehensive impression of the heavens than at earlier stages of development; and that, above all, it was accompanied by the idea of the existence of divine guidance, which, in spite of many attending errors, has always had an exalting and ennobling tendency.

We can select no resting-place in the progress of astronomy between this and the Copernican period. The additional discoveries were fewer, and less striking, though they continually presented greater difficulties in the way of astronomers who endeavoured to harmonize their observations with their ideas of the structure of the universe. But externally Christianity had introduced a new conception of the world. The structure of the universe was now acknowledged to be the work of one God. This conviction had indeed already existed at an earlier period, on one small spot on earth, among a few gifted men who lived insulated among the heathens; but we would not by this be led aside from the more general course of events. By Christianity our thoughts became purer, our exaltation towards God higher and more glorious; but this was not owing to astronomy. On the other hand, it must be conceded that, by it, the Christian imagination gains a conception of space in which to place the various habitations of the blessed amidst the countless arches of heaven.

In later times, from the Copernican period to the present day, there are many resting points; but the knowledge that has been gained during that space of time is so interwoven, that we can form a clearer view of the whole, if we at once transport ourselves to the present period; and when we have grasped what is to be seen from that position, we may, if we desire it, easily return to earlier epochs.

The observation of the heavens has now gained an entirely different character: the fixed vault has disappeared; the earth is no longer the central point, but a heavenly body floating among an endless number of other planets; it is, in fact, received into the heavenly system. This view gives us an entirely new impression of magnitude. We derive measurements and calculations from it which exhibit distances, compared to which millions of miles are nothing. The un-

initiated hear of these proportions with wonder, and view the matter with trust or doubt, according to their different dispositions; but among the uninitiated, there are some intellectual men who, with fancied superiority, have ridiculed those who took pleasure in hearing of such high numbers. Great and small, they say, are merely relative conditions: an ell is large compared to a hair's breadth, but small when compared to a mile; and again, what is a mile in comparison with the circumference of the earth? Every degree of magnitude may be opposed to another which might exceed it in quantity. Is it not, therefore, childish to delight in the high numbers of astronomy? *The relative of numbers*

This would all be quite correct, were we only speaking of abstract numbers; but this is by no means the case. The importance of these high numbers lies in their being viewed as signs and links in the system of the universe, and as an organic whole. *Signs and links* As for instance, when the bulk of a whale is valued alone by the number of ells it measures, it conveys no meaning to us; but when the creature is considered as a link in the animal creation, then the numbers become of importance; it is the same with regard to astronomical numbers, though in a far higher degree. *link in the animal creation* The peculiar nature of the case, however, obliges us to view our object more accurately with reference to this relative measurement. We always begin from some well-known size perceptible to the senses, and chiefly from some relative proportion in our own bodies; the thumb, the width of the hand, the length of the arm, the fathom, the foot, or the footstep; almost all other measurements are derived from these. *measurements* The mile, or whatever other standard we may select to express the measurement of the roads, is only a multiplication of the same scale; for instance, of the foot, or the footstep: the circumference of the earth, or its diameter, is again but a repetition of the elementary standard of the road measurement, and thus, even when we fix on the metre or pendulum as our scale, we ourselves still continue to be the elementary standard, and our imagination always leads us back to ourselves. When the exact diameter of the earth is fixed according to the established standard of measurement, we are able to determine the distances of our solar system, and also those of the fixed stars, by the distances of the sun; thus, if we may so express it, there is a connecting link between all the results of scientific measurement. But that

our imagination may embrace these calculations, we must submit them to its influence; and when we view our earth in this light, it is no more than a grain of sand to a lofty mountain, when compared to the whole system of the universe: again, the whole of the solar system is but as a drop to the whole ocean, when compared with that system of suns revealed by the multitude of stars in the Milky Way; even this great system of suns is but as a mote in a sunbeam to the whole earth, when balanced with still remoter and higher arrangements. Our imagination is at once reminded of those researches which prove that all these vast numbers form a connected series of mutually connected links of being, reciprocally acting and re-acting on each other. Well then, are not the starry heavens a far wider field for the imaginative powers than at an earlier degree of developement in the human race? and are not those ~~vast measurements~~ wonderfully rich in interest, when considered in their countless inward connections, even if only cursorily viewed as a system of magnitudes?

As a deeper insight into these things infinitely increases our conception of *space*, filled as it is with worlds and their revolutions, so is it also with the existence of those worlds in reference to *duration*. Amidst the numerous variations in the movements of the planets which have been completed, and recommenced after a certain space of time, we must allow some to have occupied many thousand years. The precession of the equinoxes, for instance, occupies a period of 25,600 years: the extremely involved variations which the inclination of the ecliptic is subject to, require a period of 40,850 years, and another of 92,930 years. The time which our system requires to circulate round the higher system to which it belongs, must indeed far exceed even these. The exact time is still unknown, but we may say with the most perfect safety that thousands of years are as nothing to it. Here again, however, if our imagination takes man and the duration of the human race as its standard, we gain an idea of the durability of nature far beyond the limited notions of ordinary life, since it neither conceives of *Being* as something dead and stationary, nor despairs over the *Finite* as ever doomed to mutability. Thought and imagination, matured by scientific knowledge, can alone discern eternity through the light of stars.

the existence of remote and higher arrangements

the magnitude of quantity & knowledge

duration

found

Science does not dwell upon inactive magnitudes; it was only that we might gain a clearer view, that we separated them for a few moments from active objects. - All enlightened men are aware that every planet is a globe like our own, though it is a singular result of the dominant tendency of our minds, that this idea only occupies a subordinate situation with most people, who are full of false opinions and ideas which must be destroyed if the full import of this truth is understood. It is not sufficient to know that the other planets resemble our earth, and that some of them are considerably larger; we must dwell on this idea, and graft it on our minds. How unimportant, for instance, are events of the utmost interest to those who may perhaps have heard of such things, but who have never sufficiently considered them, so as to be convinced of their reality. The most trifling village gossip frequently excites a greater interest than events which have altered the entire face of the globe: the same may be applied, in a different manner, to the knowledge of the structure of the universe in those who, though the study of astronomy may have been neglected, are highly cultivated in other respects. But we must not stop at a superficial knowledge of it: he who would truly enjoy the contemplation of the heavens, must live in long and intimate communion with what they teach us; he must have beheld the mountains in the moon, and admired the exactitude by which their height is ascertained by their shadows, by the order in which their summits are illuminated by the sun. Thence he must turn to the planets, and be convinced that they have not a smooth surface, but that, like the earth and moon, they also have hills and valleys: he must occasionally have endeavoured to carry himself in thought to one or other of these distant planets; for instance, to Jupiter, whence he would behold our earth twinkling like a little star, and by the aid of magnifying instruments might search for and discover our moon; he would there see the rapid alternation from labour to repose during the short day of ten hours; and on the other hand, witness the long duration of the seasons, which include more than eleven of our earthly years. Our sun will seem five and twenty times smaller than it does to us, but then it wanders in the varying light of four moons. Pursuing the orbit of this planet, which is five times greater than that of our earth, he will gain a far more comprehensive insight into

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the region of space, though he will scarcely carry away more impressions than from a dream. ~~The spirit must not tire~~; it must wander beyond our sun's dominions, and must recognize a peculiar sun in every fixed star, surrounded like ours by wandering planets, to which it gives day and night, spring and summer, autumn and winter. He must acknowledge that there are harmonious arrangements beyond even these, in which suns like our planets are parts of a great system; this again is part of a higher and higher still, thought having no limits to confine it. He who has ever lived in close communion with this idea, which we have but just glanced at, will bear it in mind when beneath a starlit sky, and will receive from it a rich and vivid impression. Should there be any one who has not experienced this feeling, and who, trusting to his mental developement in other branches of knowledge, thinks he is justified in regarding it with scorn, we may remind him of the words of the profound philosopher Malebranche, who after listening to one of Racine's tragedies, inquired, "What does it prove?"

We have not yet alluded to the idea which is suggested by the stars, of the existence of inhabitants of other worlds; but in considering what an innumerable variety of beings endowed with reason may be distributed throughout this vast space, we must not forget that it has been lately asserted that reasonable creatures exist exclusively on our own earth; and that, with the exception of man, none do, or ever have existed, throughout the universe of being.

If we view the case in an abstract light, we may possibly arrive at the conclusion that creation on our earth has attained its highest development, and that there exist no other beings endowed with reason on any of the other heavenly bodies. If we stop short at this point, we may be easily led astray by principles which are foreign to the matter; for instance, by one-sided poetical or religious views, which may bestow an air of possibility, or even probability, to the idea; but if, on the other hand, we consider the case in its whole bearing with the rest of existence, then this abstract possibility proves to be absolutely opposed to the reality. We cannot at present do more than give a hasty glance at this subject; it will, however, be enough to prove, that man neither occupies the highest position, nor can he be the only being endowed with reason. When we regard the develop-

The spirit must not tire
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ment of the earth, we behold a succession of eras, in each of which new and more perfect beings have been developed, and we observe that the human race did not come into being before the last convulsion, or rather transformation of nature. It may be dangerous to wound the self-love of the human race by the supposition that it must one day make room for a more perfect order of beings. We will, therefore, rather recall to our remembrance that our entire solar system has developed itself in a series of natural periods similar to the earth, and that each planet must still submit to a succession of creative transformations; consequently, we may infer that they have all had a succession of created beings, with such variations only as the different natural conditions of each must induce. Would it not be a strange assertion that neither the older planets, at the most remote distance from the sun, nor the ~~younger~~ and nearer ones, had any of them attained to such a degree of developement as is exhibited on our earth? Though a slight colour of support might be given to the assertion, it never could bear a close investigation; should we, however, on such grounds maintain that man ruled paramount throughout the wide expanse of the universe, we must go far beyond this. Our system is, indeed, but a small part of a far higher system, with which it has been developed under similar laws, only differing in the increased complication which the enormous difference in proportion of a system of systems must necessarily induce. The same fundamental idea of the globe and of man must be repeated in each, though borne out under different conditions; and must we believe that on none of these planets, similar or dissimilar to our own globe, reason has been awakened to self-consciousness? But we may not even rest with the impression of such a system of worlds; it only forms part of a still higher one, and must we suppose that here also reason has not attained the developement of self-knowledge? Thought never finds repose, but rises to higher and higher worlds; and except on earth, can it recognize nothing but barren solitude where no reasoning being has ever penetrated? No, it belongs rather to the nature of things, that reason should develope itself into self-consciousness, not only in one spot, but in every member of the system, although in different degrees. If we rightly weigh the imperfection of our knowledge, both as regards its accuracy, or its extent and completeness, we can

the development of a new system of beings is a necessary result of evolution.

hardly believe that man has yet reached the highest degree of developement. Associated with the most sublime enjoyment, when we have been able to gain a footstep in knowledge, we are conscious of the most ardent longing for a profounder insight, the possibility of which is dimly apparent before us. If we regard the whole of existence as a living revelation of Reason in time and space, we can conceive that the most varied degrees of developement may be found distributed through all time, and that some bodies are still spheres of vapour, others have reached fluidity; while others have gained a solid nucleus, and so onwards to the highest point of developement; and then backwards again even to those bodies which are on the verge of final destruction. But even were it possible to maintain that self-conscious reason alone existed on earth, it still remains true, and is proved by the remains that have reached us of an earlier stage of developement, that there was an immeasurably long period of time before the creation of man; is it possible, then, that during the whole of this long period there was not a single being capable of perceiving and apprehending his own existence? Let every one search whether this idea can bear a sound investigation.

It is now plain that he who is convinced by the proofs I have mentioned, that living beings are distributed through the whole of existence, will contemplate the stars with very different thoughts and views, and have a far wider field for the scope of his imagination than he who is ignorant of these secrets of nature.

We have already said that the whole universe is subject to laws, and that these laws are guided by reason. Few will contradict this truth; but when viewed from scientific ground it is displayed with greater force. Only imagine that he who from his study of the earth's movements has gained a knowledge of some of those great laws of the world, which are as simple as they are necessary for its preservation, will then perceive that the vast masses of matter wandering through the regions of space, have under the same laws and forces become perfect spheres, have afterwards modified their forms, and are now kept in their appointed paths. He must pursue the application of this fundamental idea with close discrimination, but also with enlarged views, and he will see at length that all which calculation has taught him is fulfilled. "That which the spirit promises, nature performs." Does he pe- not

feel that he is accepted as a participating link in the eternal principle of the universe?

He sees no inactive void in the remote distances between the planets. The space is filled by æther, and is penetrated by the attractive forces by which the whole universe is held together. The æther itself is an ocean, whose waves form light, that great connecting link which conveys messages from globe to globe, and from system to system. The better we understand these truths, the wider will be the view unfolded to us, and futurity promises to reveal still more secrets; the wonders of the globe, unravelled by science, prove that we are not isolated beings, but that we are related to the whole universe; and with the same comprehensive grasp, though in a different direction, reveals the fundamental doctrine of universal attraction. The observant student is carried upwards, penetrated and animated by the voice of nature; and he himself, though possibly in the smallest degree, reacts on her.

Let us imagine an observer of the stars whose imagination is stored with all the ideas we have mentioned, and we must feel persuaded that the greatness, the life, the overflowing thought,—in short, the presence of Divinity must shine on his soul with the same light from heaven which in existence meets his eye.

This example, though only one of many, ought to be sufficient to indicate, that when we resign our whole souls to that enjoyment which flows from the comprehension of nature, the more our minds are cultivated, so much the greater will be the pleasure we shall receive; and this culture can only be attained by the diligent study of those results which have been obtained from scientific research.

W. L. G. 1871

SUPERSTITION AND INFIDELITY

IN THEIR

RELATION TO NATURAL SCIENCE.

1.—*The Nature of Superstition and Infidelity.*

It is universally considered that natural science has been most influential in the extirpation of superstition, and this is confirmed by the peculiar nature of the subject, and the history of the human mind. We also believe that infidelity is often caused by the study of natural science, but this can only arise from its abuse. It may appear superfluous to submit opinions so generally received to a fresh inquiry, if we have no reason to contradict them; but a cursory glance at human nature proves, that there exists much disagreement as to their mode of application, and that this subject is rarely comprehended by the multitude as distinctly or clearly as it ought to be.

Many people imagine that superstition is closely allied to faith, and, therefore, they fancy that the extirpation of the former may endanger the latter. We must, therefore, endeavour to demonstrate, that superstition may be viewed on two sides, one of which has a casual, and, consequently, a dissoluble connection with true faith, while the other, on the contrary, is closely connected with the most fearful impiety. There are others who consider superstition as poetical, and who are therefore adverse to its destruction. We must remind them, however, of this fact, that, in the earliest ages of the human race, many objects of superstition were united, though not indispensably, with poetical conceptions; but that when superstition is completely developed, so far from realizing, it is utterly opposed to a world of beauty.

We have made use of the word superstition as a well known term, but going farther into the subject, we must determine its signification with greater accuracy, and we

will at the same time protest against the objection, that superstition is now so completely exterminated in civilized society, that it is no longer worth while to discuss it.

Every one is able to distinguish between credulity and superstition. He who gives credit to false informations, which contain nothing peculiarly extravagant, is not accused of superstition, but is only considered credulous. Even should he believe the greatest improbabilities, namely, that there is a country in which the men are usually ten feet high, and that they live to the age of a thousand years, we might consider him ridiculously credulous, but we should not confound it with superstition. But he, on the other hand, who imagines that anything is effected in nature, except through nature's laws, is called a superstitious man. For instance, whoever believes that a sick animal may be cured by the recital over it of certain magical words, must undoubtedly imagine they possess a power which does not exist in common words. I will mention some more examples of a different kind. Many people imagine that a man who has been bitten by a dog, which at the time was in perfectly good health, will yet be seized with hydrophobia, if the same dog should happen afterwards to be attacked by this illness, although by the laws of nature there is no connection between the two occurrences. The idea that when thirteen people sit at table, it is either dangerous or that it predicts misfortune, presupposes that a certain number will produce effects, or is in some way connected with powers which are supernatural. These ideas are considered superstitious, not because they admit what is contrary to nature, (for if that were the case, a man who believed that he could drink aquafortis with the same facility as brandy, would be thought superstitious,) but because they assume, although with an indistinct conception of their own meaning, that nature can act in opposition to her own laws. It is not our purpose now to enumerate the different superstitions that exist; our object is to speak of the tendency there is to believe that something, called supernatural, interworks with the ordinary course of nature. This tendency and this superstitious manner of thinking is often maintained by men who, from their education, have learnt to shun all current superstitious opinions. For instance, forty years ago, I was acquainted with a French emigrant, who would have been much offended if any one had accused him

of a belief in ghosts, but who, nevertheless, imagined he was pursued by the Freemasons, and who believed that, although he was in Copenhagen, the Freemasons, living in London, possessed an influence over his mind, and caused him nightly cramps by means of animal magnetism. I am aware that there are some scientific men who admit these kindred influences, and that some even believe that animal magnetism, like light, electricity, and the magnetism of the earth, can spread its effects into distant space; but the French emigrant, as is the case with many other magnetizers, believed in a supernatural agency. Should it even be ever discovered that, ~~in accordance with~~ natural laws, the influence of the will on the nervous system may be extended through distant space, still those who believed that it was the effect of supernatural powers would be considered superstitious. This idea ought to be viewed in the same light as if, by the aid of enchantment, we could transmit our thoughts instantaneously to our distant friends. The discovery even of the electric telegraph cannot make this rationally possible. Another Frenchman expressed it as his opinion, that it was only by the aid of the Freemasons that Napoleon was able to accomplish so much. In the first instance it was believed that a physical effect was produced by supernatural means; in the last, that the natural working of a mind which possessed great capabilities in itself, proceeded from the united influence of extraneous forces, and not from the natural laws of the mind. If this may not be denominated superstition, its close relationship to it cannot be denied.

There are also certain opinions seen from another point of view, which we must consider superstitious, though they are not conceived in that spirit. I formerly knew some excellent people living in a small and remote town, who were never troubled by doubts of any sort, and who therefore did not venture to deny the existence of ghosts, which were generally believed in by those around them, but they were not afraid of them, since they believed they could do no evil without the will of God. But the will of God is the expression in religion for the eternal laws of existence, therefore with their unscientific notions they confounded the supernatural and the natural. At the same time, I knew a man, who frequently and loudly proclaimed his scepticism in religious matters, and yet feared to go by night across a churchyard,

or to pass a place of execution. Was he not an example of a superstitious mind?

That we may understand better the meaning of what I have said, and not misconstrue the different expressions I have used, we must investigate the character of the laws of nature more closely. ~~Although we are willing to confess that our knowledge of natural science must fall far short of the task it has to perform, it is still sufficient to show us that the laws of nature are the eternal laws of reason; that to know them is to know the eternal connection of reason with nature; in short, to know that reason which pervades and rules the whole of the material as well as the spiritual part of our existence. Natural science is in perfect harmony with religion, which teaches that everything has been brought forth, and is now being brought forth and governed by the divine will. It is therefore contrary to reason as well as to the will of God to designate anything in the course of nature supernatural. I am aware that many believe that the Creator may now and then deem it necessary to deviate from the laws of nature: but if it was a real exception to the course of reason, this would presuppose a want of reason in Him who is all-perfect wisdom; on the other hand, should the exception be only apparent, and the laws of nature have really been followed, we need then only number this exception among the countless wonders which lie beyond the limits of our understandings; it would serve to humble our pride, but not to justify our inclination to believe in the supernatural. Superstition is therefore a tendency to believe in that which is contrary to reason; and such a tendency can only exist unknown to itself: for he who can pronounce that superstition inclines the mind to believe what is absurd, will undoubtedly abhor it. There is no faith in superstition, for faith must openly proclaim itself; but superstition is only a confused idea, whose real existence cannot be clearly understood without destroying itself.~~

Supernatural
contrary to
reason
god

It may be considered impossible that a tendency to what is contrary to reason should exist, and that even if it were the case, reason would render it ineffectual; but I answer, that though the human mind is not naturally inclined to abhor reason, it is neither incredible nor contrary to experience, that this should occur as a perversion of the faculties. We shall exemplify this in the course of our investigation. We can easily conceive that reason has not always sufficed to

oppose this tendency, when we remember how many people are only imperfectly conscious of their own thoughts, and are far from entirely and completely comprehending them; that their ideas often float before them in such a scattered condition, that thoughts which ought reciprocally to enlighten and reconcile one another, seldom meet.

Let us imagine a man whose ideas of nature are limited to what he perceives through his senses; not only does the spiritual appear supernatural, but so likewise do all those objects of the material world which he cannot connect in his mind with what is usual to him; therefore the starry firmament appears to him supernatural, and in his ignorance of the laws which govern it, he ascribes to it the most unnatural influence in human affairs. A still higher developed idea may be united with similar errors, which essentially belong to the same class. Those belong to this class, whose general conceptions of nature are so embarrassed by considering in what manner the material differs from the spiritual, that they are not conscious of the all-comprehensive unity of the laws of reason. Those who have so limited a conception of nature, may possibly recognize the supernatural, and not be aware of the unreasonableness of their ideas, but they unconsciously live at variance with existence, which must be felt whenever there is any exercise of thought; and if their mental efforts do not enable them to overcome their difficulties, they are left in a melancholy, soul-depressing feeling of confusion and alienation from eternal light.

This state might often degenerate with many people, particularly in the dark ages of the world, to the lowest depths of spiritual darkness, and might in its consequences lead to an abhorrence of reason and to impiety. Perhaps this may appear at first an exaggerated application of principles, and not justified by the reality; if this were really the case, I should object to such strong expressions, and regret that I should have made use of them, but I trust that on a closer investigation of the subject they will be found justifiable.

Infidelity is a state of degeneracy exactly opposed to superstition. It consists in a tendency to reject all those immediate truths which do not rest upon the impressions of the senses, and to found its entire faith on these, and on the decision of the logical understanding. Superstition and infidelity are developed in the human race in that intimate alliance, in which extremes necessarily show themselves,

Perception
through
senses

Infidelity
is opposite of Superstition

which continually produce each other; we must therefore glance at their origin and their mode of developement.

2.—*The origin of Superstition and Infidelity, and their mode of developement.*

MANKIND in its infancy learns, like the individual man, by instinctive intuition. The period of childhood, where the power of thought is but slightly developed, and where the form which is given by this faculty to the impressions of sense is still very imperfect, comprises a large portion of the time allotted by nature to the developement of man. The knowledge of himself which he then acquires, has an immense influence in his comprehension of the world. He embodies all his feelings, his desires, his fancies, into the sensible world, and imagines that everything around him is living, feeling, and desiring as he is. The inner world, which man thus creates for himself, is a world of poetry, very different from what he afterwards acquires from his thoughts; but since the same active power which we are conscious of in our thoughts, pervades and forms all our feelings, so this childish comprehension of the world is in peculiar harmony with that superior intelligence by which all nature is governed; and through it, with that character of reason, so comprehensible to our inner sense, which forms the essence of beauty, and which never ceases to charm us. If poetry could be the prevailing sentiment in this world, the life of man would be one harmonious whole, but his comprehension of the world would be vague and dreamy. He would not be fully conscious of the rational connexion of all things in the world, that revelation of the divine reason in existence: man must be led through innumerable struggles to the point where the union of all our capabilities and powers of comprehension will be evident, and where thought and poetry will no longer be opposed. The contrivance of our whole existence is arranged in accordance with this design.

*Ch. high comprehension
superior
apostolic
view
revelation
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truth
the convergence of thought*

Nature does not permit man to bury himself in the world of poetry, and he is prevented from doing so by exterior influences; objects obtrude themselves which require his constant consideration. Irresistible impressions and thoughts appear in prominent distinctness, and oblige him to look at things in a new manner. This induces two opposite sensations, either joy at the new idea that is disclosed to him,

or discontent at the encroachment which has been made into his habitual view of the world. One of these two feelings will predominate, according to the nature of the new idea, or to the peculiar disposition of each individual. We shall explain this by some examples:—The course of the seasons exercises, even in the most favourably situated countries, an immense influence upon the condition of man; in the warmer regions of the earth, it is important for him to know at what period the hot weather will succeed the rainy season, or when the drought which always terminates the hot weather, will be followed by the fruitful rains; and in the colder regions it is perhaps still more necessary that he should be acquainted with the course of the seasons. By successive observations of the heavens, the learned and their immediate pupils, are acquainted with the laws by which the seasons may be predicted, and the common people believe that these highly gifted men are in communication with the heavenly powers, and are benefactors to the human race. By their learning it is possible to make those arrangements which the predictions of the seasons require, such as agriculture, meetings for religious ceremonies, great campaigns, &c. &c. The multitude will not indeed be roused by these means to any great mental thought, but among the initiated, where knowledge is nurtured and preserved, it must soon be evident that the ideas entertained by the people, that the stars are independent gods, to whom we are indebted for all the benefits of the year, do not harmonize with those laws by which the events in nature are governed. In accordance with human nature, two opposite prejudices are created. Some entertain doubts concerning the opinions of the people in general, and also the truths which are contained, though mingled with gross errors, in a faith whose principle is really pure, while others fear to reason away the whole divinity of things. During the early developement of these opinions, neither of them will have a decided predominance, but the prevailing idea will oscillate backwards and forwards between the two extremes, and man will feel that he cannot fathom its depth. But the same tendencies develope themselves gradually, and more especially so the greater be the number of those who attain, although in a very superficial manner, some knowledge concerning the laws of the heavenly bodies; and this will particularly happen, when it is discovered that phenomena of the heavens, which people regarded with terror, appear as the innocent

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consequences of nature's laws. We can conceive the horror which would be felt if people imagined, at every solar eclipse, a monstrous dragon was going to swallow the sun; it would be much as if the powers of darkness threatened to swallow up the light; and, even after this prejudice was discarded, they would continue to regard an eclipse with fearful forebodings. But if it became generally known, that the moon, in her appointed path, intervenes for a short space of time between the earth and the sun, and that this may be calculated beforehand, it would cause a great mental excitement; and the delight of seeing their former fears vanish before those powers of nature which were previously so much dreaded, would be universal. There must be another and a still greater ~~pleasure reserved for those who, being more enlightened, behold in it a grand exemplification of the power we possess to comprehend in part the guiding hand of nature.~~

But when this fear of *one* natural phenomenon was acknowledged to be groundless, people were induced to ask themselves, whether they were not equally mistaken in many other instances of a similar nature; and, indeed, many people did not stop at the mere question. Whatever importance may attach to this instance, and whatever ideas it may awaken, yet in itself it could exert no very extensive influence, but is only one example taken from an endless number of examples. Man is constantly roused to reflection by surrounding influences; and whenever he discovers in them a cause or a harmony, he is placed in direct opposition to the former world of his imagination; having progressed so far, the most independent and active minds will not stop at the rejection of those opinions which are undoubtedly false, but will rather feel inclined to reject all which strikingly resemble them; but most of those who have adopted these new ideas, are too easily carried away to such an extravagant degree of rejection, that they are even led to deny truths, which have been mixed up with these erroneous opinions. On the other hand, there are people who cannot easily tear themselves from their old ideas; some from an earnest belief in those truths which are now denied; others, and the greater portion of those whose faith is less vivid, because by the dulness of their intellect they are deadened to all innovations. Enlightened men, delighted with their insight into the new world of

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thought, are impatient at any resistance, whose exclusive origin they attribute to the mental weakness of their opponents; whilst the adherents of the old system are filled with fear and animosity, when they behold that view of the world attacked, with which their knowledge of God has arisen. This struggle between two antagonistic prejudices does not proceed without interruption; sometimes the power of thought roused by new discoveries preponderates, sometimes a period of rest prevails, in which there is leisure to narrow the boundaries which have extended too far, owing to too great mental excitement; but there will always exist some men, who will feel with that true inward modesty, originating in a noble depth of character, that there are many questions between the disputing parties, which cannot at once be answered with a perfect conviction of their truth. They are, therefore, content to appropriate from both parties, whatever appears to them to be the most certainly true; on one side the convictions to which they are led by an inherent sense of their truth, although they have not been yet sufficiently explained by reason; on the other side, those truths which have been perfectly proved by reason, even although some differences appear to prevail between them and the old ideas. Those who are able to act in this manner, well know that where there is a contradiction the whole truth cannot exist, but they also know that the possession of the whole truth is out of our power, and that we shall never reach truth by an untimely suppression of doubt.

This shortly delineated course of developement pervades the whole history of man, and only differs in different periods and regions of the world. We shall now endeavour to represent the progress of superstition at the time when its power was most extensively spread over the world. Men were obliged gradually to receive more and more of that knowledge which philosophers were daily acquiring; but with most people this remained no more than a simple gift, and exactly that which to the more highly endowed was the most valuable, was least fitted to the views of the uneducated multitude. At the same time, however, men of even coarser understandings were led by these gleams of higher thoughts to a more varied course of ideas. But still more various is the effect obtained from those fruits of thought which have been pouring in upon mankind, as the constantly increasing inheritance of

centuries; and which is forced upon us in the daily routine of a life, whose numerous arrangements exact a greater consideration in each successive generation of man. But thought, which is here awakened, is not sufficiently worked out by the multitude so as to operate freely, and in correspondence with its own nature. Among the uneducated classes it remains subject to the government of the imagination, and its effect is, as far as possible, confined within the limits of her dominion; they wish, as it were, to comprehend things by the power of the imagination, and from this crude material to contrive a view of the world which becomes more confused and contradictory the further it is developed. During this state of things a strange confusion arises from the creations of the old poetical world, and the mass of knowledge which has since been acquired. We should be very much deceived if we expected to see this knowledge conspicuously prominent in the poetical works of such a period; for here we only behold what the sense of beauty was able to select and to transform. In historical works also which are occupied with great events, we meet with few indications of superstition; but we may in part become acquainted with it in the records of daily life. The life of the Romans was strongly imbued with it, even in its most refined age; the Middle Ages however claim a closer attention.

3.—*The Middle Ages an example of a period of Superstition.*

At different periods superstition has reached a certain height, which may be better defined from the collected circumstances of the times, though it would be tedious to mention each period separately. The Middle Ages will be the most instructive to us, and more especially so, because superstition was then mingled with Christianity, whose doctrine, when purely comprehended by man, is so exalted and so glorious, that superstition is displayed in opposition to it in all its darkest folly. At the same time that a religion was recognised which teaches that the universe is governed by a Divine will, imagination peopled it with evil spirits, who in various degrees possessed a supernatural power. They were, indeed, subject to the Eternal will,—this was an undisputed doctrine; but coarser minds were imbued with gloomy imaginations, which were at variance with the clear light of truth, and which more

than could be believed, governed life and its actions. There cannot be a better example of the folly of superstition, than the eagerness with which so many Christians, during a succession of centuries, sought the assistance of men, from whom they themselves ~~believed they could only receive support by~~ diabolical arts. It is the most melancholy delusion to seek assistance from the devil, while we at the same time believe in God: it might indeed be denominated the most ridiculous madness. We do not allude merely to individual examples, but to an opinion which was daily expressed for more than a century, in all Christian countries; but the extreme of this delusion is the idea of selling ourselves to the devil, by which, for the transitory enjoyments of a limited life, we renounce eternal happiness, and condemn ourselves to everlasting punishment. What a sacrifice at once to folly and impiety, to impiety and folly! If to the expressive testimony of history, the false objection is advanced that such impiety could not have been common in the Middle Ages, when religion was so highly venerated, I shall reply, that an impartial view of the religious practices of that period will rather prove that even these were full of superstition. The God who was worshipped was indeed the same whom Christ had proclaimed, but the conceptions concerning him in those days were totally different; they considered him a powerful sovereign, and not a spirit to whom we should pray in spirit and in truth. The single exceptions that existed deviated so entirely from the general practice, that they cannot be considered of any value. It was the common opinion that outrages, robbery, and murder might be expiated by gifts, which were not so frequently offered to the Almighty as to persons who, it was believed, had great influence with him, namely, to the mother of his Son, to a legion of saints, and to a still greater band of priests; these influential people were overwhelmed with gifts, and the servants of the church sold indulgences. I shall certainly be accused of repeating the worn-out language of the eighteenth century, but it is by no means my intention to write anything new, but that which is considered the truth, and which many are too glad to forget. I shall be told that this opinion concerning the Middle Ages has been so often condemned, and in such strong terms, that it should not be brought forward again. I am aware of these condemnatory judgments, but they no

longer alarm me, since I have sought to become acquainted with the Middle Ages through themselves, and not from the representations of conflicting parties. We should not on this account let ourselves be deceived by supposing that we are able to attribute the errors of the dark ages to a more exalted view of things. Profound truths are frequently discovered at the foundation of the errors of all ages; but we must endeavour to see how men actually thought in those days: it is only thus that we shall obtain a true idea of their condition.

It is of course understood that in the foregoing reflections our attention has been exclusively turned towards the dark side of the Middle Ages; but after this has been conceded, we must remember that error has at no period so entirely prevailed, that truth and virtue have not likewise exercised a powerful influence. What I intended to prove, and what I believe for certain is, that superstition has exercised a far greater influence upon the life and the opinions of the Middle Ages than most of the modern delineations of those times would allow us to suppose; and that, in proportion as it gained power, it displayed its folly and its impiety. It is hardly necessary to remark that none of these errors can be attributed to the influence of true religion; but we here behold one of the numerous examples which shew us that religion may be comprehended in a very different manner, according to the variety of knowledge, and the different development of the faculties of men. Mankind must be educated to arrive at a true understanding of things, and this education, though it has indeed advanced step by step, appears to be yet very distant from its completion.

4.—*The injurious effects which Superstition exercises on all the concerns of Life.*

Superstition is not only at war with religion, but it likewise meddles with all the concerns of life. To comprehend this fully, we must transport ourselves into a period when superstition prevailed. If there was an eclipse of the sun or the moon, it was feared it might betoken misfortune, and this sort of apprehension lasted for many centuries, indeed more than a thousand years after science had discovered the true cause of eclipses. When a comet was seen, the terror was still

greater; on the appearance of one, even so late as the fifteenth century, all the church bells were rung by command of the Pope. In great undertakings, astrologers were consulted, and people submitted to their decision. Even before being bled, or taking physic, or having one's hair cut, it was considered necessary to consult the stars. The signs, which were interpreted by figures, and which originated entirely from arbitrary determinations, created a fear that the world would come to an end in the year 1000, the influence of which extended over the whole of Christianity. Great confusion often arose from the blind confidence which was placed in prophecy; in cases of sickness people sought advice from men and women to whom a supernatural knowledge was attributed, and they sometimes received useless, but more frequently injurious advice. When human beings or cattle were attacked by illness or any other misfortune, the influential cause of everything was ascribed to wicked men, or other evil beings, and consequently the fear of mysterious agencies was added to their other misfortunes. Even the passing vicissitudes in the dispositions of men, for instance, love, and its transformation into aversion, were frequently ascribed to magic, and supernatural assistance, and often horrible magical potions were sought to ward it away. Darkness was filled with horrors; in woods and in mountains, near churches, in deserts, in deserted rooms, there dwelt magicians, fairies, mountain spirits, and ghosts. Hobgoblins wandered through the streets; and even within the dwellings, evil spirits exchanged innocent children in the cradle. I have naturally only been able to collect some few examples, but if we turned our attention more to the subject, we should soon perceive what a powerful influence it must have exercised. I quite allow that all these things have been gathered together here in a manner which would never occur in real life. Yet those were not few who, following their natural dispositions, more especially resigned themselves to such ideas, and to them existence must have been a species of torture. With most people these ideas would be overpowered and modified by the numerous and far stronger impressions they received from real life surrounding them; and therefore they exercised only an occasional influence over some people, and with others hardly any at all. But on the whole, they were much more mixed up with the concerns of life in those days

than appears in the beautiful poetical features with which many authors draw a picture of the middle ages. ~~It is therefore certain that formerly superstition pervaded the life of man with a restlessness, a disturbance, and often with a species of terror, with which in these days we are unacquainted, although we have not entirely thrown off its disgraceful yoke.~~

5.—*On the supposed Poetry of Superstition.*

I must now present you with another form of superstition, which induces many cultivated minds to cherish it as a favoured child of their imagination; they say it is poetical, and lament that a closer acquaintance with the laws of nature should make us prosaic. A striking want of reverence for truth and reality lies concealed behind this accusation, which we shall not at present attend to, but content ourselves with solving the misunderstanding upon which this opinion is founded. ~~It is not the belief in the existence of supernatural beings in the reality of every-day life, which makes these beings poetical; but they are indebted for whatever poetical value and importance they possess, to the way in which they have been employed by one endowed with a powerful imagination, to present to our inner perception beautiful images of a higher existence. The poet is satisfied if these beings are realized in our imaginations while we are imbibing his ideas, or mentally reflecting upon them. He must breathe such real life into the creations of his fancy, that they may be able to work upon our imaginations; and our powers of conception must be equally vivid to re-create the ideas painted by the poet. How many are there among the thousands who have been enchanted with the Macbeth or Hamlet of Shakspeare, who have believed in the reality of witches or ghosts?~~ Experience and science teach us that, in order to enter with delight into the representation of the supernatural in poetry, our belief in it must be aroused and sustained during the period of our enjoyment, but it would be absurd to desire a different kind of reality.

I know that celebrated poets have introduced characters into their writings who are placed in a ridiculous light because they would not believe in supernatural beings; but where such a representation is successful, it can only be

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directed against those who would banish the supernatural entirely out of the world of Poetry, because they considered it superstitious, confounding poetical with prosaic Reality. So far as the poet differs from this opinion, he falls into a prosaic error which has undeniably misled many a man of genius. There was a time when, both in Germany and Denmark, it was considered by many intellectual and highly cultivated men, that Religion and Poetry would be advanced by the restoration of Superstition. This attempt received additional vigour and life, inasmuch as it appeared in opposition to the very prosaic turn of thought which at that time prevailed. These times are now gone by; but those mental powers which were frequently employed in the contest for superstition, have not only left behind them traces, in the influence they still exert over many minds, but the struggle itself is still often renewed, while the writings of those days are preserved, which will always be popular from their poetical merits. It were best to cite a great example:—the poet Tieck belonged, in his youth, to that party who powerfully attacked the prosaic tendencies of the day; and he assailed them with a talent and wit which will always find admirers; but we cannot deny that he resigned himself so completely to this object, that he was led to transgress the boundaries of truth. In some of his writings we trace an endeavour to set reason at naught, particularly in his tales and traditions, where he mixes up old fables with every-day life; and they are so vividly described, that the supernatural acquires a reality which it does not possess in poetry.

When we read, or rather listen to, the story of the "Fair Egbert," or the "Venus' Hill and the Fairies," as related to us in the form of popular legends, which are completely exempt from any intellectual developement, our minds are carried back to a mental condition corresponding to the legendary days of yore, where we are not so forcibly struck by the contradictions in the story, and the immense contrast the substance of it presents with the whole of existence. But as soon as we proceed to examine the facts more in detail, and endeavour to harmonize them with a reality with which we are familiar, the contradictions become more apparent, even although the great beauties of the poem prevent us from immediately accounting for them. Such a poem in its totality impresses one with the idea that the

world is governed by the powers of darkness, and Man is its involuntary plaything; and while we resign ourselves to this impression, an indescribable terror seizes us, and it appears as dismal, looking back upon it, as if we had been imprisoned in a world of delusions where the threatened existence of man received no ray of light from the divine supremacy of reason. It is no justification of this kind of poetry, to say that the author wrote with the intention of producing this feeling of terror, and that he has succeeded, with as much talent as art. As a poet, he is bound to transport us into the world of the Beautiful: ~~this certainly does not prevent us experiencing~~ terror, but it will not suffer the powers of Darkness to overrule the light. ~~Contending for the erroneous notion that poetry~~ should be subservient to objects, even beyond its own proper sphere, people have often been inclined to allow it a degree of license, and to forget that it does not act in its true spirit if limited to particular forms of the Beautiful, but that there exists a world of beauty whose laws dare not be transgressed. For when poetry follows in the steps of beauty, she at once serves the cause of Religion, Morality, and Society, which all derive their character from the same source, and comes into harmony with Truth, as it is apprehended through our senses and our intellects. I have been obliged to transgress my limits, because I have observed how many old prejudices still remain, which are in opposition to the true light of nature. Let us warn those who think that it is a proof of a highly cultivated mind to bring to light remains of former times, that in reality they are only stirring up the dregs of a fermentation which was excited in a good cause, but has long since passed away.

We are frequently astonished that so many clever men should have seriously lamented the disappearance of Superstition, and wished to restore it to its former importance; but this wish is never seriously entertained, either among those who by inclination, lead, or follow, in the cause. It may be truly said, that they only imagine that they wish it, and that their exertions, though half unconscious to themselves, serve only to increase the dominion of falsehood and fictitious beings.

It is not my intention, besides, to deny that Science destroys some forms of Superstition, in such a way, that they can only be employed in the poetry of the present day under peculiar circumstances. For instance, it is a much more poetical idea, at least according to the notions we have hitherto

entertained, to imagine that a Dragon lies in wait to devour the sun, which we can prevent by prayers and sacrifices, than to know that the moon passes between us and the sun. But who would be so foolish as to wish to renounce such a great and productive Truth, in support of an erroneous idea. I am aware that many have been led astray by the confusion that has arisen between the words *poetical* and *prosaical*. The word *prosaic* was originally meant to denote that kind of speech which is distinguished from verse, but afterwards, it was as frequently employed to signify whatever was inimical to a poetical feeling; and thus used, it justly denotes what is low and soulless. But latterly, it has been applied in a very unreasonable and erroneous manner, to whatever is considered unpoetical; whence the most profound knowledge and learning is reckoned prosaic. Truth and Reality are often treated as prosaic ideas, which should yield their place to poetry. People who use this language are deceived by a false notion they entertain, that every conception of the spiritual nature of existence, which meets with a suitable expression in poetry, should belong exclusively to it; and whilst they cannot deny that the loftiest ideas are often met with in science, and most beautifully expressed, they fall into the mistaken notion that this is poetry; in the same way as we hear very enthusiastic Freemasons explain all morality as Freemasonry, and consider all good men Freemasons. A distinguished German author (Friederich Schlegel) who contributed much in his time to this confusion of ideas, asserted in exactly this spirit, that Spinoza was poetical. No; Truth and Reality are in themselves, neither poetical nor prosaic; the highest soarings of the spirit belong exclusively neither to poetry or prose, but are common property; and to reserve the title of poetry for the sanctuary of the mind, is an injurious abuse of language.

Therefore Natural Science is not to blame, if she destroys many of the materials which were formerly employed by poets; indeed we do not hesitate to add, that she destroys many other errors which are incorporated into poetry, but which cannot be styled superstition; therefore a modern poet would either never or seldom make use of representations such as "the four corners of the world," "the foundations of the earth," "the firmament of the heavens," or many other similar to these, because such false descriptions do not repre-

sent what is correct; which is not the case with many other images, namely, the rising and setting of the sun, &c., &c. But even if poetry did not receive a complete compensation for such losses, it would still be very unreasonable to complain; for the principal point still remains; namely, that our spiritual existence is raised and ennobled by the knowledge which destroys these errors. Moreover, such losses will be of trifling importance to the true poet; but injurious to those who make a profession of poetry, and who imagine they have given a poetical form to an insignificant idea, by clothing it in the magnificent ancient dress of past days. There are many who imagine that they speak in a grand style, when they assert that science offers but an insignificant compensation to such poetical views; but I answer in reply, that whoever speaks in this manner, owns that he derives no intellectual pleasure from a deeper knowledge of the laws of nature, and that therefore, the power we possess of beholding with such wonderful clearness the mechanism of the globe, and foreseeing the cosmical relations of distant centuries, is of no interest to him. It may be told to such as these, that it is their own stupidity which prevents them experiencing the delight of such knowledge, although they may boast of considerable talents of a different description: they are either excluded by nature, or more probably by their own fault, from participating in a pleasure which always increases in its intensity.

Since the greatness of science is sufficiently attested in itself, we have as yet only affirmed that through communication of insight, and not by anything she can actually bestow, she offers the poetical world an ample compensation for all she has deprived her of; but we must now also point out that Science bestows a real compensation for what she has destroyed in the poetical world. Poetry has long since received some of this compensation; for example, in the spherical form of the earth, to the knowledge of which the learning of the ancients had already led; this must afford a much greater pleasure to our reason, and to our sense of the Beautiful, than the idea which represents the earth flat, square, or in the form of a disk. Poetry has occasionally made use of such great truths as the motion of the earth round the sun, the planets viewed as habitable globes, and the fixed stars considered as distant suns, and centres of

light and heat to other undiscovered inhabited globes. Does not the idea of a world moving freely in space, supported by invisible powers, and wandering far into eternity, amply compensate for the idea of the firm foundation of the heavens? and is not the view into the endless variety of worlds replete with life and thought, an ample exchange for the fixed vault of heaven? The poetical imagination has not certainly made use of the new ideas nearly so frequently as of the old ones, but the constantly progressing race of man has a long futurity before it. By means of science, the earth relates its own history of distant times which long preceded the existence of man; and this has not been entirely excluded from poetry, although but sparingly employed. But the theory of the developement of the globe yields us annually fresh materials; it tells us of a time when the earth was enveloped by a sea of a high temperature, of the first islands which arose in this sea, and the progressive formation of islands, of the dumb creatures and the flowerless shrubs upon this young earth, which was enlivened by no sound, and embellished by no variety of colours; it shows how, by a series of developments, large tracts of land were formed, and already begins to mark out their boundaries. It also displays to us the progressive developement of the animal and vegetable kingdoms, and shows us the wonderful forms which were successively created and became extinct, in constant preparation for new creations. Many discoveries of less scientific importance have also been received in the world of poetry; for example, the magnet, gunpowder, spots on the sun, the borrowed light of the moon, the velocity of light, the lightning conductor, the respiration of plants, the animalcules in water, the fermentation of wine, &c. &c. The relation in which man stands as a discoverer of the secrets of nature, to all natural objects, to the whole human race, and to himself, has been but sparingly employed. Would it not be worthy of the poet, to represent the state of that man's mind who made the first scientific use of the telescope, and by its means discovered the moon belonging to a distant planet, and the mountains in our own moon? Can anything be more delightful to the poet than to reflect upon this man's enlarged and clear insight into the wide domain of existence, his consciousness of having enriched the human race with a great increase of knowledge, and his conviction that he has

prepared the certain downfall of astrology, and the numerous errors which are entertained concerning the heavenly bodies? Is it not well worth the trouble to represent to men, the inward delight which is felt by one who succeeds in unveiling the great secrets of nature, and who foresees what good effects will be produced to the human race by his endeavours? Each of the greater and comprehensive discoveries would display something similar, although not visible to all in an equal degree; but even the most prominent have been seldom productive of poetical conceptions. It is, for instance, remarkable, that the discovery of the electrical nature of the atmosphere during a storm, has never inspired the poet with a desire to represent it. The discovery was the fruit of scientific reflection, but it was proclaimed to the world by an heroic act, for the discoverer conducted the electric fire from a cloud by means which endangered his own life. He was assisted by his youthful son: we can conceive the mental excitement the father must have undergone during the experiment, the innocent or the heroic sympathy of the son, and the sensation of triumphant joy when it was concluded. As far as concerns the sympathy of the son, the poet is free to choose whether he will suppose the father has not at all considered the danger of his son, or has communicated it to him but to prove him, and has concealed the precautions which he has taken for his security, whilst he must necessarily expose himself to danger. We may further imagine the repeated outcry of prejudice against the lightning-conductor, but at the same time its disappearance when experience had proved the full merits of the discovery. I am here reminded of an incident in real life, which no poet's invention could have surpassed. There was a church-tower in Sienna which had often been injured by lightning; the church overseers provided it with a lightning-conductor, against which the slaves of superstition protested, and called it the heretical stake; a storm arose, the lightning struck the tower—crowds flocked to see whether the church had been spared, and, behold! the conductor so completely verified its power, that even a spider's web upon it remained uninjured.

It is natural that he who has always lived in the atmosphere of obsolete ideas, will be little compensated by the new ones; and he will still less allow that this compensation is immense, and far outbalances his loss. Important indivi-

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dual examples may indeed prepare the mind for such a conviction, but cannot accomplish it; it can only gradually become general, and at length conquer, when the knowledge of science is so increased, that it not only belongs to the understanding, but likewise cultivates the powers of the imagination. It is only by means of such a mental development that a new poetical world will be unfolded in opposition to the old one, in a mental sense perhaps no less important than the discovery of the New World was to the so-called Old World. This development will not fail in exercising a legitimate, and certainly a powerful, influence on the use we make of the ancient poetical world. Among other things, a more delicate perception will be formed of the harmony of reason, which, however much it may be hidden from the eye of the multitude, must exist in the widest range of true poetry, and thus that license which the thoughtless multitude often mistakes for originality, will more and more lose its admirers.

6.—*The Effects of Infidelity.*

We have been a long time considering the effects of superstition, and the false tendency of the mind which favours it. It will not be necessary to dwell so long on the effects of infidelity, although they are extremely injurious; but since it originates from the spirit of inquiry, it carries with it the germ of its own downfall, and therefore it gains neither so enduring nor so extensive a rule as superstition. We have already seen that infidelity consists in a tendency to reject that part of spiritual things which men believe in from a direct inward sense, and which is not proved by reason; it is caused by the numerous instances in which scientific discoveries refute opinions which have been received without investigation. In the course of inquiry, many opinions are likewise refuted which were adopted in former investigations; but mind rectifies its own errors: not to mention that during a long period of time, it is the errors of superstition particularly that mind must remove. It is natural that this should create a doubt against that manner of thinking which has so frequently been found in error. Doubt is soon changed into distrust; and this creates, with many people, an excessive tendency to reject everything, added to which, there arises an

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exalted idea of the power of mind, which is really good in itself, but is apt to degenerate into arrogance. The independent feeling which is created, by being delivered from so many natural bonds, degenerates also with others into a wild license, which despises every restraint; and according to the degree of this degeneracy, there arises a rejection of all religion, a ~~fancied wisdom which exalts itself above all ideas of virtue and duty~~, although it would willingly subject weaker minds to their influence. It can be easily conceived that poetry cannot flourish with such a spirit. The adherents of infidelity often receive aid from the want of sense they meet with among their superstitious opponents; this want of sense soon becomes persecution, which lends a certain value to error, both because the understanding scorns any forcible means which are used in place of conviction, as by the consciousness that he is suffering for the sake of truth. There is a certain point of developement, which the highest minds have reached, who are most zealous against superstition, and who in their zeal are led into extravagancies, that, indeed, does not spring exactly from infidelity, but yet in the misunderstandings and party strifes of the period, causes them to appear to stand on the side of infidelity.

In so far as infidelity gains the upper hand at any particular time, it thereby approaches its own destruction. Morality is undermined, and consequently little valued. All the secret ties which unite families and states, are loosened; ~~everything sacred is scorned~~; and the spirit of persecution becomes associated with it, as it was formerly with superstition; but this condition bears with it the germ of its own downfall, and if the mental powers are not able to overthrow it, it ends in great revolutions and regenerations of the social system, which, as is well known, are accompanied by such throes that they must be considered as the tremendous punishment of degeneracy. It is an understood thing that neither infidelity nor superstition, at any period, can attain an exclusive power. The reason inherent in our being, together with the instructive influences of the surrounding world, prevent most men adopting entirely either of these one-sided views, although few are able to remain perfectly uninfluenced by them. A higher power has so provided, that evil cannot retain an unlimited superiority, but that germs of a newer and more noble developement remain, even when a particular

evil has increased in power to such a degree that great revolutions are necessary.

7.—*How Science counteracts Superstition.*

It appears that most people attribute the most important effect which science exercises in the extirpation of superstition, to be the destruction of superstitious notions. This is, indeed, a very important office, but not the only one; and I should not even call it the most important, if it were not the point from which all the others spring. It is very evident that the action of the spirit of enquiry, by means of which a superstitious notion is eradicated, not only succeeds in destroying that particular notion, but at the same time it rouses a feeling of distrust in other notions of the same sort. This important secondary effect is generally but slightly promoted by the destruction of one superstitious notion, but is encouraged and rapidly strengthened by the united effects of several discoveries in science. Let us first imagine the superstitious notion withdrawn, by which it was supposed that a solar eclipse indicated that a dragon had swallowed the sun. This will indeed have a great effect on the reflective powers of many, but the impression will be soon weakened among the multitude, and will not lead to continuous reflection. Superstition believes in a Sun-god, who rests every evening in the sea, and renews his course every morning. Science teaches us, that the earth is a sphere, across which daylight moves from east to west in the course of four-and-twenty hours. Superstition assumes that the fiery car of the sun would burn the earth if it were to approach it too closely: Science teaches us, that the sun is neither a car of fire, guided by an arbitrary will, nor does it approach too near the earth. Superstition had her Moon-goddess, which likewise exercised much influence upon the earth: science taught that the moon also is a sphere, and has an allotted path. The destruction of such superstitious views must elicit the thought that the whole course of the Heavens is subordinate to fixed laws; whereby those opinions which presupposed events of the Heavens, proceeding from the arbitrary influence of the gods, turned out to be fallacies. Before I proceed further, I will combat a misunderstanding, which, from what has preceded, has not yet been set right; I wish to say, that

it is not the poetical signification of the mythological representations mentioned here, which I denominate superstition, but the truly prosaical conception, which formerly governed these objects in every-day life. Having made this, perhaps, superfluous remark, I shall continue my observations. The idea that the events of the heavens are governed by fixed laws, was not at first believed in its complete signification; on the other hand, during many centuries, it remained within narrow limits, which recognized the doctrine of chances. Even those who knew the course of the heavenly bodies, were always alarmed at the appearance of a comet. A century and a half passed before science released the uneducated multitude from this fear, and it was a much later period, before it was driven from the minds of the mass of the people; in fact, not until it was known to the world at large that the return of a comet was predicted seventy-five years before its arrival. For a long time, it was believed that the destiny of a man might be foretold by the situation of the stars, at the time of his birth. The absurdity of this idea was first displayed when it became an established fact, that the planets are worlds like our own earth, and the fixed stars are suns. These instances of the influence which science exercises against superstition, instruct us that it was not merely the custom of seeing such superstitious notions destroyed, which operated most strongly against superstition, but rather the acknowledgment, which had grown into an inward feeling, among some people, and had become perceptible to the multitude, that the course of the heavens was determined by natural laws. This effect constantly increased, as a more perfect knowledge was obtained of the clear evidence of natural laws. The distinct comprehension of the true system of the world, made it impossible now to adopt the notion of one or more fixed heavenly arches, as was formerly the case; but by that means, many conceptions of heaven, or the road to heaven, were destroyed; conceptions, which had grown up with the religion of many people, although wrongly so, since the material signification of the expressions, "the abode of God and the blessed," &c., &c., ought, in all cases, to be rejected; and the words only be received in their spiritual sense. Lastly, the knowledge founded by Newton, of the natural necessity of the heavenly laws of motion, must increase the conviction that no arbitrary changes are admissible in the motions of

the earth. From this we can perceive that all these laws are laws of reason—certainly far beyond what our minds could have devised ; nevertheless, divine dictates of reason, which, happily for us, we are able to comprehend. This conviction receives an invincible strength by resting upon a knowledge in which thought and perception are most intimately united. I have chosen this connected series of examples, because by that means, we examine various portions of the influences which the natural sciences exercise against superstition ; namely, that in the first place, they actively destroy superstitious ideas ; next, by the force of habit, they cause many superstitious opinions to be doubted ; and further, by pointing out that a great part of the effects of nature are regulated by laws whose unity, connection, and unlimited extent of action, and whose necessity, as a necessity of reason, as the unalterable will of God, are all manifested by a profound and penetrating investigation. All this is repeated in the influences which the remaining parts of science exercise ; although it would be difficult to find another series of examples so easy to survey, but this one series will partly enlighten the succeeding examples.

The changes of the weather belong to those events in which men have been inclined to see indications of a humanly arbitrary, I might almost say capricious, sovereignty of the Divinity. That God should bestow rain or drought, storm or calm, as an earthly governor dispenses benefits or punishments, is a notion still held by many people, and not likely soon to disappear. In the meanwhile, as we advance in our knowledge concerning atmospheric phenomena, we perceive that they proceed according to the laws of nature, which are of universal validity ; heat cannot increase to an unusual degree in one place, without diminishing in another ; the direction the wind takes in one country depends upon what takes place in all the other parts of the world : the same change which causes a drought in one country bestows a superfluity of rain upon another. The more perfectly the universal validity of the laws which regulate these occurrences is seen, and the knowledge of it is spread, the sooner will that superstitious opinion disappear of an arbitrary distribution of such natural effects, which is so far beneath the conception of an Almighty power. Among the superstitious notions of this kind, held at different times, the

idea that God expressed his anger in thunder and lightning, was most strongly advocated. The discovery of the electrical nature of lightning, and particularly of the lightning conductor, most completely annihilated this superstition, although in some ways but slowly; for thought, like electricity, only moves with the rapidity of lightning, under a good conductor; but as the conducting effect of the lightning conductor became visibly apparent to the dull multitude, now here and now there, their prejudices against it were necessarily shaken. In one of the cases mentioned at p. 75, the event worked like a miracle upon the people, and we repeat it—Lightning, whose path is controlled by a conductor, has destroyed many prejudices.

I have cited this well-known example that you may remark how the enlightening influence by which science disperses superstition, often acts with considerable and sensible force, but seldom so powerfully as in this instance, although practice and experiments always speak with energy. I will bring forward some more proofs: let us carry ourselves back into the beginning of the seventeenth century. At a certain place in France,* there fell a shower of blood. Some monks immediately began to interpret this event as a dreadful sign of divine vengeance; but a naturalist [Peiresc] showed that the so-called drops of blood were found in places which were under cover, and where, consequently, no rain could fall; and that it was caused by a swarm of insects. It is well known that we have often been misled by other phenomena to hold similar opinions; for instance, we have mistaken a kind of red moss, after it had been washed and swelled by the rain, for the production of a shower of blood; an error which was likewise rectified by naturalists. The stone-rain, as it is called, has also, of course, occasioned superstitious ideas. Science has not indeed given us all the desirable explanations about it, but has yet done sufficient to withdraw it from superstition, while she points out some of the laws which that phenomenon obeys, and has instructed us that nearly all the meteoric stones are composed of the same chemical components. Much of the power of science is displayed in the various arts of trade, and she thus greatly contributes to remove many superstitious opinions, and (what is still more important) to spread and to strengthen the habit of reflection. How very

* Near Aix, in Provence, in 1608.—Tr.

common superstition was among miners! Their occupations led to so much that was mystical, dark, and dangerous in itself, that superstition could easily take possession of them. Without denying that a great deal of superstition was always retained, particularly among the uneducated, who only heard isolated results of science, and those indeed through various mediums; yet the light which science gradually kindled concerning the interior structure of mountains, and all the different departments of mineralogy, spreads an important knowledge which is hostile to every kind of superstition, particularly among those who are not of the very lowest degree of civilization. But the discoveries in science must have thrown a faint light, even on these. Among other things, a belief formerly prevailed among miners that evil spirits threw them down and suffocated them, in the mines; or, that they produced the phenomenon of explosive and destroying gas. Science has powerfully counteracted this early dread of evil spirits, by the propagation of the knowledge of explosive gas, and of the different kinds of air that are noxious to breathe; and still more, by protecting the miner with the Safety Lamp. However imperfect may be our acquaintance with the nature of fermentation, yet the knowledge which we have acquired concerning Nature's laws, which are there at work, has destroyed many mysteries, and has been very advantageous to the purpose for which it is applied. On that account this knowledge has been almost necessarily received by distillers, brewers, &c., &c., many of whom have only been induced to acquire some scientific knowledge, in the hopes of self-advantage: but besides the thought which this study induced, and which appears the principal object many different superstitious notions were at the same time also destroyed. I remember, in my childhood, some people who were distillers, and who had experienced many misfortunes in their business, attributed them to the power of witchcraft, and they even threw suspicion upon certain individuals. In the present day, since we have become familiar, through science, with the laws of fermentation, and that we possess also comprehensive directions on the manner of proceeding, which is rendered necessary by the occurrence of different circumstances, we shall in most cases escape such mischances, and where they happen, discover the reason of them. It was formerly believed that basilisks existed in

cellars which had been long closed :—they were invisible, but their look killed whoever it fell upon. Since it is become more generally known that fermentation is produced by a noxious air, whose weight causes it to accumulate in low places, we recognize the destructive agent and drive it away by means of fresh air. In our days the various applications of the steam engine to so many trades, in navigation, and in railway communication, has led people in general, and particularly men in business, to much reflection. The numerous other machines, which often perform the most skilful works, must have had an equal effect. The Electric Telegraph has attracted people's attention, even in those countries where it is only known by name. These numerous discoveries, among other effects which they have accomplished, have brought man to the knowledge that the most wonderful things may be produced by using our reasoning faculties ; but these great undertakings have not alone contributed to the mental developement of the human race ; there is hardly any branch of traffic which it has not seized upon, and roused to reflection. This awakened spirit of reflection is nearly allied to the spirit of inquiry, which is developed by science, on which, from its beneficial results, we must lay peculiar stress in reference to the extirpation of superstition.

Science is generally able to refute the superstitious ideas which are connected with nature, but more particularly those which rest upon a mistaken conception of an actual existing object : it stands, however, in a totally different relation to those objects which have no foundation in nature. The spirit of inquiry, awakened by science, and the method of inquiry will destroy the former, but the latter is always more difficult to extirpate. An instance of the false idea we have just mentioned, is the supposed danger of thirteen people sitting at table. The remark that thirteen people were assembled at the Last Supper, does not give the least ground for the foundation of such an idea. Many a person refers to his own experience, but if he is asked what it was, it only consists in this, that after he had once sat at table where there were thirteen people, one of the guests died within the year. But what does this experience intimate ? Even if it had occurred to him more than once, the spirit of investigation would not recognize it as a proof. It would say, that the single experience of one individual, in an affair of such importance, cannot be granted as

a proof: it is necessary to learn the experience of many people, after several years' uninterrupted recorded proofs, of the number of guests at various tables in different societies, and the number of those who died during those years; by that means a medium would be gained, which would show that the more numerous the guests had been, the larger proportion of them would have died within a certain space of time: But he who truly comprehends the laws of nature will not require this decision, since he knows that the opinion under consideration does not at all coincide with nature's laws. But I hear many a clever man, who is in other respects educated, say "I will not exactly maintain that the fear of sitting thirteen at table is well founded, but my imagination is so absorbed with this notion, that I may be allowed to retain this harmless error." Whereas others remark, "this is a very different thing; we must suffer this peculiarity in others, but should any one suffer it in himself?" Would it not be better to summon his irrational fear before the judgment-seat of his own sound reason, and to condemn it to death? The error is trifling enough in itself; but the power which is conceded to such a false notion, favours a pernicious disposition of the mind. If we discovered that we had a disease in our body, which we were able to subdue, we should certainly do so; but is not every superstitious idea equally a disease of our minds; and should we not endeavour to subdue this? What has been here said of a single case, may be easily applied to many others, We will not stop to go through them; all that we could say of one more than another, would little increase the effect. The scattered remnants of superstition will only gradually lose their power over the imagination by means of the spirit of inquiry, for the constantly increasing application of science is even distributed over that which does not properly belong to her, but only comes in contact with her in her various applications to human life. But this effect cannot be compared to that which is derived from a proper study of science. It developes in the mind of man an entirely different inner world, not merely something which is simply received and stored up in the memory, but as a constantly renewing existence, in which he recognizes an all-comprehensive working of the eternally living reason. Here, therefore, no room is left for superstition to enter.

Perhaps it will be now objected, that individual naturalists have not been entirely free from superstition. We may of

course, with justice reject every example which has no particular reference to the development of natural science; for, although forming one whole, still it is subdivided into different parts, which could not be developed with equal rapidity. It is true, that all these subordinate parts of science, from the very beginning operated against superstition; but for a long time this could only succeed in certain directions, whilst science in other parts continued to advance along with superstition. Astronomy, that department of science which, when the human race had hardly emerged from infancy, dispelled so many superstitious ideas, was not able, for many centuries, to free itself from the follies of astrology; indeed the adherents of this folly were only able to throw it off entirely when Newton appeared, and the laws of the heavenly movements being all proved to be connected with one another, it was found impossible to combine them with the superstitious notions that formerly prevailed. The example of astronomy will suffice for the justification of similar objections, in relation to the other branches of science. It would be more injurious to our opinions, if examples could be brought forward of men who had acquired a great deal of knowledge in a highly developed branch of science, and yet were not free from superstition. I am uncertain whether such examples can be pointed out, but I believe it is possible. Perhaps its effect may be lessened by the remark, that human nature is apt to be inconsistent in the course of its ideas; but in most cases, and perhaps in all, it will be found that no one can be superstitious in any department of which he has a profound knowledge, assuming that he is profoundly versed in this department. Yet it might happen, that even he who has acquired a considerable proficiency in a particular branch has worked it out in such a one-sided manner, that he cannot bring himself to believe that nature everywhere obeys as stringent laws, as in that particular province with which he is best acquainted. I, therefore, think it impossible, that any one in possession of our present knowledge of astronomy could have the slightest tinge of superstition with regard to the heavenly movements; on the other hand I should not deny it as absolutely impossible, though I should consider it very doubtful, if I heard any one say, that an able astronomer fostered superstitious ideas upon subjects which were foreign to his sciences. But perhaps I am wrong to admit so unreasonable an objection.

8.—*The influence of Natural Science when opposed to Superstition.*

We have seen how science in the course of its development causes infidelity. We particularly dwelt on the consideration how in those numerous instances where ideas and opinions have been refuted which we were accustomed to connect with the most sacred convictions of man, they have been frequently shaken and even destroyed by science. It is easy to perceive that science herself operates against the doubt and the arrogant rejection of profound truths, which she herself has unintentionally called forth; for while she is always continuing to purify and explain knowledge, she will destroy many a false argument which originates in a less perfect knowledge; she refutes and rectifies her own errors, exercising the spirit of investigation, and separating the true from the false; and while she allows us to feel how easily we may err, she teaches us a salutary distrust of our own judgment.

If we only intended to treat of the somewhat casual encouragement which infidelity receives from science, our apology has already been given; but science, from an effort peculiar to its nature, has awakened a dangerous idea among many people, which, if pursued in a one-sided manner, might lead to atheism, namely:—while she points out that all the operations of Nature are subject to laws, and that these laws are necessary, invariable, and eternal, she has caused many people to believe that this necessity, which pervades everything, is a blind necessity which, belonging also to Nature herself, precedes all reason, and should therefore be independent of it. This way of comprehending things pre-supposes inanimate matter to be the foundation of all existence, which has been from eternity, and which possesses certain necessary properties: all that we denominate the spiritual, has been produced from its equally necessary mode of acting; and even our power of thinking is only the result of the properties and movements of portions of matter. Every one feels how unsatisfactory is this way of comprehending things, and would dread the effects of science, if this were all it led to.

The best answer to this is the well-known truth that an

opposite idea has been held by most of the labourers in science, since they point out in Nature the most admirable foundations for rational intentions, so that we are accustomed from the wise arrangements of Nature to obtain a proof of its origin in all-powerful reason. This would suffice, if we only required a superficial apology; but in that case, not to mention that we should leave the matter with that discontented feeling which is caused when two antitheses remain irreconciled, we should also leave an important accusation untouched. As science advances she always leads to a more perfect discovery of the laws of nature; and at each step shews us their more intimate connection with one another, so that the necessity of all that happens becomes more and more evident. It may be objected on the other hand that the wisdom of the contrivance is likewise always more perfectly recognized; but the irreconciled point of dispute faces us with still more urgent summons, in all its restlessness, doubts, and possibilities of infidelity. We will therefore bring forward the truths of science which may best explain the matter.

Without regarding what we learn from science relating to the designs of Nature, and to the wisdom revealed in the attainment of these designs, we are led, by observing the complete necessity of the laws of Nature, to the conviction that Nature must be a contrivance of Reason. Science namely represents the laws of Nature to be laws of Reason, which however, our reason, restrained within various limits, would not have discovered without the assistance of Nature; but with this assistance, actually finds it out. The result of all our observations on the laws of Nature is, that they altogether form an endless unity of Reason. The necessity is there, but it appears as a necessity of Reason. But if it were still objected, that this necessity of Reason is also a necessity of Nature, and that our whole spiritual being is her work, and that therefore it must conform with Nature, we should then be able to answer, that this neither can nor should be denied; but that it is no objection, because necessity ceases to be a blind fatality, if it is recognized as a necessity of Reason in that sense of the word, where it not only indicates what must necessarily be admitted by *our* reason, but that it is conformable and necessary to that reason from which all the laws of Nature spring. But this answer will not be sufficient so long as people consider matter to be the foundation

of everything in Nature, and not merely as a part of her essence. It is one of the earliest, we may say, the original prejudices of the human race to seek for the simple and the invariable as such in the material: certainly a very little reflection was necessary to shew that all bodies are perishable; but then we only regarded matter. It is true, in all our experience, it seems imperishable; but let it be observed, it is not the various and dissimilar materials, but that ponderable something occupying space, which is common to all matter; in other words, the matter which is universal in all bodies. According to the earliest system, matter was supposed to consist of extremely small bodies, of unequal size and form, but of extreme hardness: this idea certainly found a ready acceptance in science, but it does not belong to it; we have indeed no knowledge of matter but from its acting power, and from the laws of Nature, by means of which it operates. If we investigate the peculiarities to which matter is subject in each individual body, we perceive that these peculiarities rest upon laws of Nature, by which laws the effects are produced. Our investigation is indeed arrested before certain materials, which, for the present, we must consider simple elements; but science leaves no doubt that this is a mere passing idea. We may perhaps hit on some peculiar materials, which may be really acknowledged as the fundamental elements of matter, but even then our only power of distinguishing them, is by the laws of their action. In short, matter is not an inanimate existence, but an expression of activity, by which all the pervading laws of Nature are determined and restrained. The principle of action and the order in existence are not, therefore, two distinct objects, but one living, constantly creating, and regulating totality of Reason, an eternal living Reason, which is, God!*

But does not all this necessity exclude the idea of design and wisdom? By no means, if we only remember the immense distance which exists between infinitely perfect wisdom, and that of all finite beings. Even in the exercise of human reason, whether on a machine, on the government of a state, or on a scientific work, we shall always find a more perfect harmony in the parts, the juster and purer are our conceptions of the primary idea. We often discover agreements

* The whole of this paragraph should be compared with the conversation entitled the Spiritual in the Material.

which only owe their origin to the consistent application of the primary idea, as if different dispositions had been formed for their production, although they really spring from the peculiar harmony of reason; but every individual expression of reason, that is to say unlimited reason, is a result of the peculiar nature of reason, and therefore is at once the means and the end. We can only exemplify this imperfectly by instances, though at the same time, these are not entirely useless, if the meaning is properly appropriated and applied. As a mental experiment, let us imagine that everything we know concerning the form of a sphere was still unknown, and that an artist endeavoured to discover a form that should appear alike on all sides, that should balance itself if placed upon a horizontal surface, should have a surface which would inclose a greater space than any other form of the same size: what an extraordinary depth and variety of thought it would require! But he, on the other hand, who starts from the principle of this form, viz. that of a space whose surface is everywhere equally distant from a centre, will find far more beautiful and remarkable properties from the necessary development of this idea, while a mere endeavour after this end, without a previous knowledge, would either never be successful or only by a circuitous means. Let us now turn to Nature herself; but let us only bear in mind in the idea of the universe, that precaution by which, in the endless variety of existing beings and life, one object is never allowed to interfere with another; how can we conceive a wiser design, than the distribution of the whole mass of the universe into innumerable habitable spheres, each possessing its peculiar days and seasons, containing degrees of heat, density, &c. &c.? How could we imagine anything better than the arrangement, by which a large proportion of these spheres derive light and heat from one sun, and whose periodical days and seasons are determined by the revolution of each round its own axis, and by their several orbits around the sun? But all these and many other designs connected with it, are the necessary result of those laws, by which the parts of matter, and motion, and attraction are directed. Viewed in a finite light, the end and the means are separate; in the reality and as a whole, they are one. If we now turn our attention to our own world, we see the most beneficent arrangement, such as the alternation of days and seasons,

produced from the comprehensive and necessary laws of Nature. If, on the one hand, we regard the beneficial effects which are produced by the movement of the sea, by the ebb and flow of the tide, we must, on the other hand, recognize that they necessarily spring from the same general laws. If we bestow praises on the vicissitudes and equalization of heat, which are caused by various currents of air across different tracts of country, we shall again discover that they are consequences of the general laws in connection with the expansive power of heat. Let us now enlarge the idea from these examples to its utmost extent, we shall then see that the belief in the ends which Nature has in view, does not exclude necessity; and, again, necessity does not exclude these ends; but as the poet says,—“The means and end embrace each other in reason.”

Thus true science excludes infidelity as well as superstition.

ALL EXISTENCE A DOMINION OF REASON.

The essential Unity of Intelligence throughout the Universe.

The first chapter contains the substance of an address I delivered at the Scientific Meeting at Kiel in 1846, and which I shortly afterwards added in German to the report of the meetings of the Assembly. Although this treatise first appeared in the German language, it was nevertheless originally Danish, and I had already communicated it verbally to many Danish auditors in 1845, at a meeting of the Society for the diffusion of Natural Science. The present paper however is not a mere reprint of the above-mentioned report; it has received many improvements, and has been much extended. The succeeding chapters were written very lately.

The object for which I request your attention, namely, an enquiry into the essential unity of the Understanding Faculty throughout the universe, does not at first appear to belong to natural science; but on a nearer view, we perceive that it ought to be associated with it. Nature is not only material, it is pervaded and governed by the soul, ~~as is expressed by the eternal harmony of her laws~~; our body is clearly one of the objects of natural science, yet it contains all the organs of our understanding. Science has taught us much about the organs of our senses, and is continually making farther advances in this direction; but she does not rest within these limits, she penetrates into the structure and arrangements of the nervous system, and still has the task before her, of enquiring into the connection between these organs and our faculties;—a problem which science has hitherto but little contributed to solve, though she has given us some important hints, and towards which her efforts are continually turned. We shall feel how important this enquiry is to our whole investigation, if we consider how an imperfection in the organ of the understanding confuses a man's comprehension of the world, and indeed all his ideas of human and divine objects.

While it is proved by Science that the laws by which our earth and all its inhabitants are guided, are also adapted to

other planets, her enquiries extend to the inhabitants of the whole universe. Many of the learned reject these enquiries with scorn, because they cannot be proved with mathematical certainty; but when we consider the insecurity of the early steps in every branch of science, and that if we despised the first beginnings, we should never reach perfection, it seems to me that it would be of use to the cause of science, that we should try our powers in researches of this kind, only endeavouring to keep as near as possible to that which has been already proved, and distinguishing between the uncertain and the certain.

This enquiry may have the appearance of soaring into the region of metaphysics, but it will be shown in the sequel that it remains within the bounds of Natural Science, and does not attempt to discover the origin of all knowledge. The philosopher may regard this inquiry in the same light as he would those of the physiologist on the organs of sense; the efforts of the naturalist in the promotion of his own science at the same time prepares experimental matter for the use of the philosopher.

I hope that when I assert this essential-unity of the understanding faculty throughout the universe, that no more will be understood by this than is warranted by the expression; and that it may be distinctly seen that unity of essence does not exclude the greatest variety in the forms of existence. We need only look round our own inhabited planet, and we shall discover most striking examples of the unity of essence amidst the greatest variety. What different forms, for instance, exist in the organs of breathing among different classes of animals! [lungs, gills, tracheæ.] How different again are the organs of motion! [arms, fore-feet, wings, fins.] Equally dissimilar are the organs of hearing, so strikingly exemplified in the Mammalia and fishes, that only an experienced observer can detect the same intention and an essential resemblance in the means supplied by nature. It is hardly necessary to mention that there must be an infinitely greater variety on the other planets; indeed, there possibly may exist mediums of understanding there, which we are ignorant of here.

I must apologise for one more warning. In the following pages, I am going to prove in some detail, that the laws of nature hold good throughout the universe. This universality

has been presupposed by all who have entered on physical researches, and assuredly with justice; for in the connection and results of their discoveries, this is sufficiently proved. It is not these enquirers that I here endeavour to convince; I rather beg their indulgence; but I address those, of whom there are many, whose contemplation of nature has not perfectly convinced them of this truth. I also perceive that I might have included this, and the rest of my communication, in very few words; but I thought it better to approach the subject by a more explanatory discourse.

I shall present my ideas in the form of examples; but I shall endeavour so to select them, that general conclusions may be easily derived from particular instances. We will first turn our attention to the laws of motion, and convince ourselves that ~~these primary laws are such as are required by our power of understanding, so far as it rightly comprehends itself: on the other hand, that these laws, independently of us, are obeyed by nature.~~

We know that the straight line is the simplest; we see this at once when we consider it in a mental point of view; as whether we imagine a straight line in our minds, or describe it visibly to our senses, it is always associated with one uniform unalterable idea. This is more clearly developed and proved by mathematics. Let us now further consider that a simple force must produce a simple motion, and we then perceive that this must necessarily be the first law of motion, namely, that every simple impulse must produce a rectilinear motion; ~~and behold nature has constantly obeyed this law, long before man discovered it.~~ It is a necessary law of reason, that what is without will is incapable in itself of determining upon any change, and therefore that no motion can either be accelerated or diminished, or even change its direction, without the intervention of new effects: in other words that every simple motion must have a uniform velocity and be in one direction. This is so manifest to the reason, that we can scarcely believe that it is ~~only during the last century that it has been clearly developed.~~ But in pursuance of this law, there is a further consequence, namely, that each constantly operating force every moment receives a fresh impulse of motion equal to that imparted at the beginning, ~~and that the velocity thus produced must increase uniformly, so that the velocity acquired at any time must stand in pro-~~

portion to the time elapsed since the first moment. This simple truth, viewed on mathematical principles, led to the discovery of many laws which were hitherto concealed from experience; but which, now that inquiry had been started, readily yielded to its researches.

By the application of these truths, we arrived at the knowledge that every curvilinear motion is the result of compound forces, and not of simple ones. That all active forces which diverge from one point, operate in planes which have a given relation to the squares of the distances; that their power therefore must stand in every point in an *inverse* proportion to these squares, is a very simple demand of reason, but has been only recently acknowledged.

If we ~~cannot prove satisfactorily to our minds~~ that universal attraction is a law of reason, it nevertheless is a fact whose incontrovertible truth must be acknowledged by reason, and which has received a far higher application from the operation of the law of the inverted squares of distances. By the further application of all this knowledge, the laws of central motion were discovered; and in reference to those movements by which all bodies in conformity with the laws of universal attraction are urged towards a central point, it has been proved that the paths described must be of the form known by the name of conic sections: thus we are convinced when by experience, an orbit is discovered, that it must be produced by a force which follows this same law. All these researches, therefore, prove that the movements of the planets are governed by the same laws as those of a projected body on the surface of our globe.

I cannot be expected now to develop all the proofs of what I have just communicated; such an undertaking would not only require a series of discourses, but would be superfluous; as every one who has studied these subjects knows that the truths to which I have alluded with such brevity have been acquired by the uninterrupted efforts of profound thinkers during nearly three centuries. I may therefore consider this great scientific fact as generally acknowledged, namely, that those laws which have been discovered by the efforts of the mind when matured by experience, are valid for all the movements of the heavenly bodies.

Let us now endeavour to apply this to our present purpose, and to show that the universal validity of these laws, recog-

nized by reason, also compels us to adopt the idea of the essential similarity of the understanding faculty throughout the universe.

In our endeavours to gain general ideas, I fear we may fail in distinctness; and we will therefore now turn our attention to some one planet, and we shall soon see that the particular features which we there notice may easily be comprehended under general known laws. We will make an imaginary experiment, and suppose ourselves placed on the planet Jupiter. We will watch the transition of days and nights, and experience the various seasons as on our own planet, only with the difference of the durations and other proportions. These changes arise there, as here, from the rotation of the planet on its axis, and from its orbital motion round the sun; both these movements are produced by the same simple laws which we have discovered on our own globe, and applied to the universe. We shall there likewise see moons which obey the same laws as our moon, and we shall also be able to comprehend those phenomena by the same powers of the understanding as exist on our planet. Let us now suppose another creature placed in our position, differently constituted in every respect, but possessing the same consciousness of natural impressions. Such a being might differ from us in the form and mode of his perception; but so far as the harmonious laws of nature are rightly appreciated, his understanding faculty must agree with these laws, and consequently with our powers of thought. If his understanding did not accord with the laws of nature, it could then neither be guided by reason nor truth, but would be irrational and false; an idea which is as irreconcilable with our conception of the understanding, as the gift of sight would be with blindness; and which we therefore dismiss at the first glance, but will afterwards more thoroughly refute it. If we attempt to reverse the case, and begin to doubt whether we had perhaps comprehended things wrongly, while the inhabitants of other planets were correct; or that they are equally mistaken, though in a different manner; we reply that the prophetic nature of the mechanism of the heavens gives us confidence; for we learn from it to foretell the most various events in the heavens with the utmost exactitude and security. Putting aside the numerous predictions of the eclipses of the sun and moon, and the particular positions which the planets should

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occupy at certain fixed periods,—predictions, each of which would astonish us if we were not so accustomed to witness them,—we will only call to mind that after the short period of four years during which observations had been made on Uranus (a planet discovered by Sir William Herschel in 1781,) it was calculated that it required eighty-four years to complete its course, and what is still more remarkable, that Gauss, from the observations of a few days, accurately calculated the orbit of Ceres, and that her position was actually found by the result of his calculations; that Le Verrier, from the apparent irregularities in the movements of Uranus, discovered the orbit of an unknown planet, whose position he determined on a particular day. Every one acquainted with the subject knows I have only mentioned here but very few of the triumphs of astronomy, merely to call attention to the subject. The number of exactly determined and fulfilled predictions is beyond calculation. They must spring from elementary truths of unquestionable authority; and an opposite opinion could not accord with natural phenomena, and consequently must be untrue.

Let us again turn our thoughts to the inhabitants of Jupiter. We now perceive that neither the course of the sun, the moon, nor the stars, nor indeed that of the whole universe, can be calculated by different laws from those which we acknowledge; that consequently they cannot comprehend their movements in a different manner from ourselves. The same laws which they have discovered in the study of the heavens, they will find again on the surface of their planet; from the agreement between the actual movements of Jupiter's moon with those previously calculated from the laws of nature, it follows with mathematical precision, that the laws of gravity are the same in those planets as in our own; as, for instance, here all bodies fall with equal velocity in a vacuum, so it must likewise be there, only allowing for a different measurement of space. It necessarily follows that the projectile movements there, as here, describe curved lines in which the same laws are displayed, and it is equally certain that the laws of circular motion must be the same there as here. It is true we cannot support all these conclusions by facts derived from observation, as we are able to do in relation to the heavenly movements, but this is not requisite, as they are only necessary consequences of already ascertained truths. Yet it may not

be superfluous to verify it by a fact drawn from experience. We find that the form of Jupiter has been produced by the same laws as those which govern our earth; we know, indeed, that the last approaches the form of a perfect sphere, but still deviates from it to a certain degree, as towards the equator it is somewhat larger in circumference: we know that this deviation arises from the rotation of the earth on its axis, which causes every portion to be carried round in circles, in which the centrifugal force of the parts has a definite relation to their distances from the axis. When, therefore, we are acquainted with the circumference of the earth as well as its diameter, and the period of its rotation on its axis, we are able to calculate the distance which the centrifugal force every second would carry each individual part away from the centre, and we find that at the equator it amounts to 1-289th part of that motion which the attraction of gravitation towards the centre endeavours to impart to it. It would surpass my limits now to mention all the additional considerations which have caused the earth to assume its present form; it is sufficient to know that all who are conversant with the subject have agreed in the essential points of the calculations they have hitherto severally arrived at, and that this again has been confirmed in all essential particulars, by measurements. The same calculations may be applied to the other planets,—for instance, to Jupiter. This planet has a far greater diameter, a swifter rotation, and the gravity on its surface exceeds that of our earth. From all this we can calculate its deviation from the spherical form, and find that this deviation is far more considerable than on our earth. The form of Jupiter is determined by astronomical measurements of its axis, and by its diameter at the equator, to be in exact conformity to what had been previously fixed by calculation. From the researches on our own planet it is proved, that its density must increase towards the centre; and we learn by calculation that it is the same with Jupiter. We thus perceive that the natural laws existing on the earth are made visible to us on the surface and in the substance of Jupiter.

The inhabitants of that planet therefore, as is the case on our own globe, may apply their understanding faculty with as much effect on what most nearly surrounds them, as on the ~~movements of the heavenly bodies.~~ This similarity by no means excludes great differences; thus, for example, we may

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calculate that the weight or gravity on the surface of Jupiter is two and a half times greater than it is on our earth; that the rapidity of descent in falling bodies in various parts of this planet, presents greater inequalities than it does with us; and that its density is far less than that of our globe. But all these differences have been produced by the same laws.

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Should the inhabitant of Jupiter be able to comprehend all these relative conditions exhibited by Nature, he must, indeed, be acquainted with her laws. He may, possibly, have a clearer, a more vivid, and a more comprehensive knowledge of them than we possess, or, on the other hand, a far weaker; but, as far as he recognizes these laws, the real nature of his understanding must be similar to our own. A straight line must to him, equally appear a simple motion; and a curved line, on the other hand, the product of more than one force; the same mathematical progression must equally give him the idea of uniform accelerated velocity; to him the relation between Abscissæ and Ordinates in curved lines is the same as with us, as for example, in the ellipse, which is the primitive form of planetary motion, or in the parabola, which bodies describe when thrown in an oblique direction. But to comprehend these relative conditions, we are conscious that there must be an exercise of reason in connection with the perceptions of the senses. If differently constituted beings comprehend these same truths, they equally require the employment of their reasoning powers; and as they are beings with senses, this comprehension must not only rest on the operation of the outward, but also of the inner senses: in short, every comprehension of the laws of Nature is an exercise of reason on a sensational basis. You will meet with a sufficient number of examples in the sequel which will make this more distinct; I will now only dwell a few moments on the dissimilarities which may occur united to these similarities.

I know that many will be inclined to reproach me with alluding to the possibility of such dissimilarities; and on that account I will meet the doubt at once, though I will afterwards treat the matter with greater detail. The similarity which I have placed in the mathematical comprehension of the subject would not be destroyed, even if the inhabitant of Jupiter had a power of calculation, which so far surpassed ours, that he could as easily comprehend and calculate sums

of ten figures as we do those of two; or if by a single effort of mind, he could master a series, which would give us infinite difficulty to comprehend; or, in an equally rapid manner, if he should be able to comprehend all the relations in a conic section, as easily as we perceive the similarity of all the radii of a circle; still the conditions of the mind would be the same. You will easily perceive that all this may be applied to thinking, which is quite apart from mathematics.

All we have said of the planet Jupiter may be applied with equal force to the other planets, though some of them may present a less perfect, others a more complicated representation.

Our considerations have hitherto kept within the limits of the Solar System, we must now extend our view beyond it. We are taught by our researches that the laws we have mentioned reach beyond this system, and the presupposition of their universality daily receives greater confirmation; but if it is true that they are throughout the universe presented to the comprehension of self-conscious beings, it necessarily follows that this faculty must in its nature be everywhere the same.

Let us select another example no less striking and universal in its operations; the laws and effects of light. Nature and thought again meet here in the most perfect agreement; thought matured by experience now anticipates the phenomena we have to expect, now resolves that which was unforeseen, into comprehensive terms. In the visible operation of light we again encounter the straight line. All which experience teaches of the effects of light at different distances, of the magnitude and form of the shadow of reflected light, may be deduced from the acknowledged laws of reason, and are all necessary consequences of reason. The same holds good of the refraction of light, its solution into colours, its polarization, interference, &c., if we only look farther and consider that obscurities still remain which must be dispelled, but which do not prevent us from recognizing with certainty the essential and reasonable connection of existing laws. It is easy to believe that the laws of light, as well as those of motion and attraction, operate throughout the Universe. The light which we receive from the sun, the planets, and the fixed stars, is of a similar nature to that which is produced on our globe; it is refracted and reflected and collected into

images by our perspective glasses and reflecting telescopes, in the same way as the light which proceeds from terrestrial objects. The greater proportion of that which we wish to prove rests on an endless number of experiences connected with the subject, which will be clearly understood by all who know the principle of our optical instruments. Our experiments on light equally prove this in a different manner. We produce the same chemical results from terrestrial light as from the light of the sun or other heavenly bodies, and develop colours from it according to the same laws, thus exhibiting in a more visible manner that identity which optical instruments have already taught. We polarize all light in the same manner, whether it be terrestrial or proceeding from the heavenly bodies. From Astronomy we derive that great fact demonstrated from the aberration of light, that from whatever part of the universe light proceeds, it has always equal velocity. We must add to this that the phenomena of light which we observe on those planets which are provided with moons, for instance, the shadows that are thrown by each moon on its presiding planet, or that these cast on their moons, always obey the acknowledged laws of nature.

The relative conditions of light, therefore, as much as those of motion, prove that there are no limits in the immeasurable range of the universe, beyond which the laws required by our reason would be invalid.

This is a good opportunity to offer some examples of the great differences which may exist together with the essential Unity. We already know from the creatures on our globe the wonderful variety in the mechanism of the eye; how different it is in the mammalia, the tribe of fishes, or in the insect world. And how much greater must be the difference between the visual organs of other worlds compared to that on our planet! On the other hand it is scarcely probable that any conscious beings exist, to whom light does not convey some knowledge of distant objects.

We may learn from the theory of light, that great varieties may possibly exist in the sense of sight. It shows us, namely, that light is produced by vibrations in æther. We only receive actual impressions of light when the breadth of these waves of æther are between the 300 and 175 millionth part of a line, and but little impression from such as are below, or above

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this proportion. Those waves of æther, which are too slow for our sense of sight—that is, those waves which are of a greater breadth—produce a sensation of heat; the quicker ones manifest themselves by chemical effects. There may be visual organs which are only adapted to receive those slower vibrations, or again, others only fitted for quicker ones, or even some for all that we are susceptible of, along with many others. This possibility is not an abstract notion, but firmly based on the nature of existing matter; for we know that the rays which do not affect our sense of sight, are yet reflected and refracted, in obedience to the same laws as those which are visible to us, and that they therefore are also capable of producing pictures. Those rays which are distinguished by chemical effects, it is well known, present very beautiful images of things.

As the impressions of colour are produced in us by vibrations in the æther, of unequal velocity, so colour may be exhibited to other beings in a different manner again; but in spite of this dissimilarity, there will still exist considerable agreement, and the dissimilar velocities of the vibrations will produce as many dissimilar impressions, within those limits which are set to the inward perfection of the senses. The faculty of perceiving colours may, however, be greater in other creatures than in ourselves. Among the colours which we perceive by our senses, red is produced by those tremulous motions of the æther which are slowest, and violet colour by the ~~quickest~~, but the former, as we have already said, are not twice as quick as the latter. The utmost relative velocity in vibrations of colour on our globe, even to the most susceptible eye, are between one and two. We are much in the same situation with regard to colours, as one whose sense of sound could only grasp the compass of a single octave would be in relation to tones. A creature whose visual organs embraced as many octaves of light, as we do of tones, would be endowed with a perception, and with sensations which are denied to us.

A dissimilar susceptibility for the reception of dissimilar degrees of light, must also produce the greatest differences. We will again turn our thoughts to Jupiter. This planet receives five-and-twenty times less light on every square inch than our planet does. The light thrown upon objects may

be still further diminished by a duller atmosphere. It is, therefore, most probable that its inhabitants, in order to distinguish surrounding objects, may possess a more acute perception of light than ourselves. But this greater susceptibility also accompanies them in their contemplation of the heavens. Inasmuch as their atmosphere is not very much less transparent than ours, the stars will appear far richer and more brilliant to them; they will therefore learn more from their observations, and consequently will gain much more easily a comprehensive knowledge of the universe. From the rapid rotation of this planet, nearly twice as quick as that of our earth, they receive an impression of the apparent revolution of the heavens, in quicker succession, which must also influence the impression itself. We can indeed conceive that the quick interchange of day and night may be united with a corresponding variety of activity and repose, and this again be accompanied by a quicker and more vivid susceptibility, as well as a more rapid disappearance of impressions. To this may be added, that the inhabitant of Jupiter has a better view of the structure of the universe, by the far larger orbit of his planet; and he is also able more easily to make those calculations which are requisite to determine the distances of the fixed stars.

It is of course, understood, that I have have merely mentioned possible, or probable circumstances, which are only necessary under certain conditions. It is evident that other conditions may exist; for instance, a greater or less perfection of those parts, which in the inhabitants of other planets might correspond with our nervous system. My present object was only to show how the greatest differences may exist with unity of nature.

I will only say a few words on the sense of sound. All vibrations of a certain velocity, in bodies of sufficient density, affect our organs of hearing, yet the vibrations of atmospheric bodies, it is ascertained, are most perfectly adapted to call forth in us the most varied and most definite sensations of sound. Vibrations must exist on all the planets; but it depends on the organization of their inhabitants to determine the rapidity of the vibrations which shall excite sensations leading to the recognition of the surrounding world.

I have hitherto only offered examples, which, in a compre-

hensive sense of the term, may be called mechanical; we shall be asked for *chemical* examples, for which purpose, however, the word must be understood in a still wider sense; we will now endeavour to give some of this description. It must be acknowledged that ~~chemical laws are as much laws of reason as are the mechanical~~. This assertion cannot indeed be so fully borne out in respect to the former, as to the latter. It is an important fact in the history of science, that chemistry was developed at a much later period than mechanics; the knowledge of heat, electricity, and magnetism, and even of the combination and decomposition of matter, during the sixteenth century, was but very slight; chiefly gathered from the isolated facts of experience, while to the investigator into the laws of nature, their harmony was but faintly and at intervals disclosed; but their dependence on reason has become more and more clear with the increase of our knowledge. I well know that I have represented as the result of history, that which to the reflecting mind is self-evident, but it is not sufficient that this truth should be granted; it must be brought prominently forward, that the inward perception of it may be complete.

How gradually and widely the discovery has spread of the unity of the laws of nature in the phenomena of heat; and how perfectly the dictates of reason are obeyed in the radiation of heat, as well as in light! Our knowledge of electricity made but slow progress during the seventeenth and beginning of the eighteenth centuries; but since Benjamin Franklin discovered the fundamental law, namely, that the two different electricities are to be viewed as universally distributed active forces, and magnitudes of an opposite character, we perceive how one discovery springs from another. Reason could now derive many smaller truths from one distinct and definite truth, and point to them in nature. The discovery of the voltaic battery, suggested indeed by galvanism, was yet, in another point of view, the result of this theory; and how many effects produced by this battery were subsequently discovered, by means of reflection, guided by experience. It had scarcely been proved that the voltaic battery could decompose water into its primary elements, than the most beautiful discoveries on the effects of electric chemistry followed for a succession of years, and still continue. The researches into magnetism

made a similar step in advance during the seventeenth and eighteenth centuries, and afterwards became connected with the discovery of electro-magnetism. Every one knows that this discovery had been long demanded by a thoughtful consideration of nature; but that when it really arrived, it was found far more comprehensive than was before expected. Whether the new law of circulation may be referred to the electric stream or the magnet, or whether, by further discoveries, to a simpler law, it became a guide to new conclusions which were confirmed by experience.

In the course of the same century, chemistry advanced by the constantly combined influence of thought and experience. At first, indeed, the laws which were discovered were considerably clouded by error, which even in a more advanced state of learning is unavoidable; but the newly discovered laws were always more and more freed from this mist, and stood forth as a necessity of reason. In our own times we already see the dawnings of mathematical laws in the combination of matter and the connection of forms with the constituent parts; I say the dawn, not because the discoveries made here are more subject to doubt than many other branches of human knowledge, but because it is evident that what we now see, is only the morning dawn of that which is to be expected in the future.

It is of the greatest importance to enforce on our minds, that the discoveries of this century have proved the unity of all those effects which we have just mentioned. This unity cannot indeed be so perfectly represented as the unity in the laws of motion, but it has still been so much confirmed and cleared up by the discoveries of our century, that it can no longer be doubted. Added to this we already see numerous indications of a future, in which the chemical and mechanical laws of nature will be more intimately united.

In short, the natural laws of chemistry, as well as those of mechanics, are laws of Reason, and both are so intimately connected, that they must be viewed as a unity of Reason. The question now is, whether chemical as well as mechanical laws prevail throughout the universe? Reason demands it, but this will not satisfy us; we must, therefore, submit the whole case to mental contemplation.

We began by endeavouring to prove, that the general properties of matter are everywhere the same. Extension

and form we see in the heavenly bodies; connection and divisibility cannot indeed be actually perceived in distant planets, but it will be presently shown that we are compelled to acknowledge them by other properties. It is most important to remember, that weight or gravity is one of the fundamental properties of matter. It is recognized as the phenomenon of universal attraction, but it will be useful to our purpose to give it a closer examination. It is proved by mechanical science, that if it were possible for all the planets to be brought to an equal distance from the sun, without regarding the inequality of their masses, they would fall towards the sun with equal velocity, and that the moon is subject to the same law with respect to her presiding planet. This is as certain as the laws of Kepler, and the principle of mechanics. We accordingly see that same law, of the equal velocity of falling bodies, which we have recognized on our own earth, hold good, though in different proportions, in the tendency there is to fall towards the sun, and of moons to fall towards their planets; but we do not even rest here, for, on further enquiry, we perceive that the same law operates among all the heavenly bodies.

That which has been called impenetrability, and which is really a result of the force of extension, proceeds from the attraction which we have already alluded to, which exists on, and in, all the planets; for without some resisting power the force of attraction would compress all parts towards one point. We may express this also in another manner. Every part of a planet must, in consequence of the gravity of other parts, not only bear the pressure of the overlying, but also the side-pressure of the surrounding parts, all which is alone possible by the so-called power of impenetrability. Wherever the forces of attraction and extension exist, there must also be connection, and if this connection is not insuperable, which is hardly possible, there must also exist separation of the parts, consequently divisibility.

Besides this, the planets exhibit the similarity of their matter to the earth, by their capability of reflecting light; for without this similarity they could not have that necessary effect on the waves of æther which produces light, so as to cause reflection. But even the self-illuminating planets could not create waves in the æther without this property: even supposing we admit a different theory of light, a mechanical

force would still be wanting to emit it; for even the theory of Newton requires this force, to hurl out the particles of light with immeasurable velocity.

The power of motion, which is reckoned among the general properties of matter, is displayed throughout the system of worlds in which all is motion. Inertia, which is only the absence of will in the inanimate, is exhibited through the whole universe in our numerous predictions of the movements of the heavens, which are verified in their fulfilment.

We may now pass on to qualities and effects, whose universality we are apt to neglect, although we partly recognise it, in important predictions.

That the laws of heat are not confined to our globe has been long and justly believed, which is confirmed by the knowledge of the present day. Those rays of heat which proceed from the sun, follow exactly the same laws as the rays of heat belonging to our earth. It is also now acknowledged that heat and light differ only in the different degrees of velocity in their æther-vibrations, and that it is possible for the rays of light to pass into rays of heat. As radiation must be considered as the basis of heat, we must admit that the laws of heat prevail throughout the universe. With us the solid, the fluid, and the æriform state of bodies, all depend on degrees of heat; if, therefore, matter is everywhere the same, these circumstances will also exist everywhere under similar conditions.

We see here an ample confirmation of the assertion so long maintained, that the planets, not only with regard to light, but also in reference to heat, have the same distribution on their surface, of days and seasons, as exists on our globe. Particular causes will of course produce an exception to this distribution, as, for instance, Saturn's ring.

Let us consider further, that our experiments have shown, that bodies may become electric and magnetic by friction, by contact between dissimilar substances, or by variations in heat; and we can scarcely doubt that the same effects, in conformity with similar laws, are at work in other planets, and that it is the same with the productions of heat and of light, of magnetism through electricity, and again of electricity through magnetism.

All this must also apply to chemical effects, in the more limited acceptation of the term; to the combination and ana-

lysis of matter. By means of electricity we can produce the most various internal changes, and why should not a powerful stream of electricity, which converts a body here into dust and vapour, do the same on other planets? Must not the electric stream, there as here, dissolve the union of antagonistic materials, and must not its force, when so directed, preserve the chemical divisions of quantities?

A distinguished chemist, and an excellent experimentalist, not many years ago, was led to a supposition by some difficult researches connected with his science, which was opposed to the universality of one of the great laws of nature; namely, that the masses of different substances which have equal weights on our globe, did not possess it on other planets; which in other words means, that the law of attraction was not universal. As a true experimentalist, however, he tested this idea, and weighed those bodies which had raised this doubt in his mind, at different and stated hours of the day and night, so that if the sun did not attract this matter in equal proportion to the earth, there must be an inequality in their weight; but after weighing them most carefully, he found no difference. It was thus proved, that a relative condition which is intimately connected with the study of the inner nature of bodies, has unalterably asserted its universality in chemistry. Innumerable messengers from the region of space have in a remarkable manner made known to us the resemblance in the nature of matter both of the interior and exterior of our earth, and have even pointed to a similarity which enters more into particulars than we could have learnt from any other source,—I allude to meteoric stones. Though their composition may undergo new combinations on entering our atmosphere, yet their general agreement with the bodies on our earth is very striking, both with regard to the elementary parts, the combination, and the crystals proceeding from it.

Thus there exist everywhere the same materials, the same forces, the same laws; and these laws are founded on reason, and consequently can only be acknowledged by reasonable beings.

We have still to consider a most important side of the question: the similar manner of development of all the planets, and what we may thence derive for our present object. We know that the earth was in a fluid state before

it became solid. Among the proofs of this truth, there is one which may be applied to all the other planets, namely, the variation of our globe from its spherical form, which we have already noticed on other grounds. It is indeed an acknowledged truth, that the forces which have produced this deviation from the spherical form in the earth, could only have effected this while the planet was in its fluid state. Now as this deviation also exists in other planets, so far as we have been able to determine their form and rotatory movement, and as the relative condition of the different diameters in each of these planets, are such as are demanded by the natural laws with which we are acquainted; it is proved that the other planets must also have been, at one time, fluid.

If we are now thoroughly convinced that everything in material existence is produced from similar particles of matter, and by the same forces, and in obedience to the same laws, we must also allow that the planets have been formed according to the same laws as our earth. This we know, however, that they have developed themselves during immeasurable periods of time, in a series of transformations, which has also influenced the vegetable and animal creation of those periods. This development began with the lower forms, and advanced by gradual steps to higher, till at length in the most recent periods a creature was produced, in which self-conscious knowledge was revealed. We must therefore allow a similar mode of development in the other planets. There may be many which have not yet attained such a degree of development as our globe, or again other far higher beings may have been created; but everywhere the creatures endowed with reason are the productions of nature in the same sense as ourselves, that is, their understanding is bound up with the organs of their body; therefore the nature of their understanding cannot be fundamentally different from our own, but must obey the same laws. I now only speak of an undeniable fact with respect to man, without encroaching on those profound researches, as to the manner in which the Spiritual is connected with the Material. That I may avoid the mere appearance of Materialism, I must direct your attention to the conciliatory principle, that the same nature from which man springs, must also be recognized as the produce of the eternal creative Spirit; and that accordingly the divine origin of our soul cannot be denied, by granting the

I have been thinking of this for some time. I have been thinking of this for some time. I have been thinking of this for some time.

rights of Nature. In other words, the conception of the universe is incomplete, if not comprehended as a constant and continuous work of the eternally creating Spirit. The creative portion of this conception is the Spiritual; the Material is the produce of the creative, and would cease, if it were possible for the work of production to cease. As a product of Nature, the Spiritual in man must in this sense contain the laws of Nature, although they are only brought into consciousness by natural phenomena; while surrounding nature without human aid must operate in accordance with man's faculty of understanding, although this understanding faculty may in general, only after several thousand years, attain an insight into the pervading harmony of existence. It is easy to perceive that the grounds which lead us to this conviction are also everywhere valid. Throughout the universe there are beings endowed with the faculty of understanding that they may be able to catch some sparks of the divine light: and God reveals himself to these beings through the surrounding universe, and rouses their slumbering reason by that Reason which reigns through the sensible world; nay, he gives them a deeper insight into material existence, the more their own minds are awakened; and thus they find themselves placed in a ceaseless and living development, which, after having reached a certain point, removes them farther and farther from the idea that the foundation of Being is that which is palpable, and which leads them to acknowledge and view themselves, their spirits and bodies, as parts of one eternal organism of Reason.

Thus do the truths of Natural Science continually approach nearer those of Religion, so that at last both must be united in the most intimate connection.*

The Fundamental Similarity of the Laws of Beauty in the Universe.

It is the essential unity of the active forces of existence, as well as those of intelligence throughout the Universe is

* It will not escape notice that I here repeat many truths which I have mentioned in other portions of this work; but as they are each time presented in a different connection with the remaining portion, and could not be omitted without injuring the remainder as a whole, I hope these, and a few other repetitions may be pardoned.

proved, it follows that a like essential unity must prevail both in the sense of the Beautiful, and in the conscience; but this will not be so easily acquiesced in, without entering into more detail. We will begin therefore with the sense of the Beautiful.

It has been already shown by what we have said, that the same fundamental forces and laws prevail in other planets as in our own; that the living beings of other planets are produced by the same forces and laws as those on our globe; that they are endowed with a thinking faculty of the same nature as ours, though probably very different in power and clearness; that they must possess sensational faculties, by means of which they are enabled to apprehend material effects, and not only have these faculties organs of external sense, but also an inward capability to receive and preserve those impressions, which have come through the senses; in short, an inner sense. Added to this, there is the power to apprehend those impressions, which by the vibration of external bodies are produced on the frame of the self-conscious being, and also the power to obtain knowledge of the outer world by the vibrations of the æther. The first of these propositions is indeed necessarily followed by the remainder, but they have been fully explained in the preceding pages.

If we contemplate the feeling for the Beautiful, as it is revealed to the rational inhabitants of our planet, we find that its essence consists in this, that our inner sense is so formed according to the laws of reason in the rest of existence, that it is satisfied with whatever bears the stamp of reason; although this enjoyment does not necessarily imply any consciousness of this reason. This truth is demonstrated in our former dialogue "The Fountain;" but to those who desire a more ample explanation, I refer them to my paper "Two Chapters on the Study of the Beautiful in Nature."* The same law must exist for the thinking and sensational beings of all the other planets. This truth requires no actual proof, though indeed a closer examination, to be accepted. It has been shown in the first part of this paper, that the inhabitants of other planets must comprehend the laws of motion in every essential point as we do; among other things, as has been already pointed out in the figure of the moon's orbit, which was predetermined by the truths of mathematics; they must also recognize in the circle, the ellipse, the parabola, &c.,

* Published in German. Hamburg, 1845.

the same laws of reason as we see in them; and as they are beings with senses, and have been produced in time and space, and therefore are under the influence of things in time and space, they must interpret those figures produced by the mathematical laws of thought in a similar manner as we understand them. All figures in harmony with the laws of nature may be viewed as mathematical, so that the term mathematical is superfluous, and need only be used to direct attention to those figures which are most generally treated on mathematical principles. The sense of form must thus have a similarity of nature in all the planets, it must be everywhere in harmony with reason, it can therefore only find satisfaction in what is reasonable, and come into collision with all that is unreasonable. Let us imagine a perfect circle drawn beside a rough attempt to describe the same figure, and we can have no difficulty in perceiving that the mind which is better pleased or equally satisfied with the last as much as with the first figure, cannot be moulded according to the laws of reason. The same might be repeated in the delineation of every other figure; this single example points to many others. Symmetry is one of the most comprehensive forms of beauty to the inhabitants of the earth, but it is founded on one of the principal features of thought, the unity of opposites; we cannot therefore imagine that the beings of other planets should not find beauty in symmetry, because in all these the sense of the beautiful must be in harmony with reason. The human form on our globe expresses the highest form of beauty which can exist among earthly creatures; though the pure expression of the idea is somewhat obscured by the peculiar development in each individual man, and besides, frequently by a strong mixture of accidental circumstances; but where this idea is approached with an exalted view, or where it has been seized and represented by the artist, we then see before us the highest form of beauty which the material world can afford, [see p. 24.] On each of the other planets the being in whom reason has most completely developed itself, will produce an impression closely allied to this. We need scarcely mention that the form in which this idea may be expressed on other planets must not only depend on the force and completeness, but also on the material conditions in which the creature has been formed.

Here on earth bestows a feeling of joy which is

3
 "sense of beauty"
 not independent
 in harmony with reason

grounded in the nature of things; to comprehend this, we must consider that light as well as heat is produced by æther vibrations. In whatever manner we may view the differences between them, it is still certain that those effects of nature which produce light may be lessened so as to produce heat, and that those which engender heat, may be increased to the creation of light. We shall not err if we admit that light is produced by quicker, and heat by slower æther-vibrations, even though we have not mentioned all the differences that exist between them; but the condition of bodies essentially rests on heat. Their expansion or contraction, and the reciprocal mobility of their parts are determined by their amount of heat; we may indeed in a certain sense say that they are inseparable from the condition of heat; even the forms which they assume depend on the reciprocal action of heat upon them. Let us suppose that all bodies gradually lost their heat, they would contract more and more, and at the same time grow harder, and would become internally torpid; in fact, they would in time die away and vanish. It is true that it has been ordered by the original plan of existence, that this cannot happen; but on the other hand it is no less certain that inward action and life depend on heat. Now light is the great source of heat in our daily apprehension of nature, and is more clearly manifested to us in existence, and by that almost unknown inward connection which we have here brought forward. Man requires no scientific research to feel the connection between Light and Life, since Light itself is indeed quickening in its actual effects. It seems to influence everything, but it acts most sensibly on the nerves of sight, on which it operates with such immediate force, that through the visual organs it alone conducts the most comprehensive perception of external nature to our inward consciousness. Light is the great proclaiming power of the world. This is so true that nothing is better known; but because it is so continually present, there exists but an imperfect and slumbering knowledge of it among most people, so that to enable us to comprehend the source of its enjoyment we must be reminded of it; the true enjoyment of light, every one must have learnt by his own experience, if at all conscious of what passes within him.

All we have here said relating to the inhabitants of earth must equally apply to the inhabitants of other planets.

Light acts throughout the world, and on all bodies. We have shown that its operations follow the same laws throughout the universe. He must have but a very small feeling for Nature, who does not at once feel convinced of the truth, that wherever there are alternations of day and night, and of light and shade, that all living creatures must have a perception of light; indeed, we must carry out this idea still farther, for since the effect of light is universal, and one planet transmits light to another, the living being upon this planet must necessarily have a perception of light, and the being endowed with self-consciousness receives a revelation of another world. Let their organs of sense, even their whole material frame, be entirely different from ours, still if we grant them to be created in harmony with the laws of Reason, which we have found prevailing throughout nature, so far as our knowledge has reached; then their enjoyment of light, and their sense for the Beautiful in the visible creation, must obey the same laws as with us. To give still greater force to this idea by a more enlarged view, we will turn our attention to that impression which the contemplation of the stars must equally make on the inhabitant of another planet, as on ourselves. As his sense of sight under similar conditions receives similar effects, even so the heavens must be a vault to him, as our heavens appear to us; it must seem to him, as to us, a dark ground on which the lights of heaven shine. The surface of his planet, with all that is trifling or impure on it, must vanish in darkness beneath his nightly sky; while, on the other hand, he receives numerous and clear impressions of light from distant worlds. His thoughts must be led away, far from his daily occupations, and be so enlarged that he conceives a great image of existence, which becomes richer and more vivid, the deeper he penetrates into Nature.

We have already observed that on every planet vibrations are produced by the reciprocal action of bodies, of the same kind as those by which sound is generated with us; that living bodies are not excluded from participating in these vibrations, and that as certainly as they are conscious of what passes within them, they must be affected by them. We may besides add, that the laws by which vibrations are regulated are so entirely the result of a natural state of things, that they must prevail everywhere. All the lesser vibrations of a similar stretched musical string must last as long on other

planets as on our own; the increased velocity in the vibrations of different strings must be in proportion to the increase in the square roots of the extending forces, or in the diminution in the length of their diameter; wherever vibratory motion is given to a flat surface covered with dust, the same figure will be described in every part of the universe as with us; and it will likewise be everywhere the case, that the masses of air which are inclosed in a pipe, are not brought with the same ease into every possible kind of vibratory motion, but that by means of external action each mass of air is enabled only to give those particular vibrations, which are not opposed to the reaction from within. In short, all outward conditions of the effects of sound exist on other planets as on ours; they act on living bodies which are subject to the universal and fundamental laws of Nature; and these, if we grant that they are conscious of the harmonious changes which exist around them, must be very differently impressed from those who do not perceive how the dependence on the law is sustained. Well, are we not forced to acknowledge that the primary laws of sound everywhere exist?

I touch but briefly on the study of the universality of the laws of the Beautiful, partly because the matter viewed in its present connection does not require any great detail; partly also, because the nature of the subject does not afford any very complete application of our method of inquiry.

The essential Principles of Morality the same throughout the Universe.

To exemplify this I will again begin with the consideration of what passes on our own planet. I shall be obliged to allude to much that is well known, and even the connection which I intend here to exhibit, cannot be new; I must, however, express it as I comprehend it, otherwise that which I have to say would be misunderstood.

It has been already explained in the earlier divisions of this book, how the contemplation of Nature when founded on reasonable grounds proves that all existence is an everlasting, perpetual, active work of the Eternal and Living Reason, which, when viewed in its Self-consciousness and Personality, we name God. We must therefore distinctly remember that

the human race is a part of this whole, and that every single man as one of the race becomes a part of the great Unity of existence; in order that we may place ourselves upon that point of view from which the ideas and feelings relating to right, duty, virtue, piety, and all that is connected with them appear in harmony with the rest of Nature. What we learn in reference to man may be applied, in the most essential points, to all reasonable beings in the universe, namely, we infer that as our inquiry into the laws of unconscious Nature began with objects on our own globe, and by degrees advanced to the knowledge of those natural laws which embrace all the objects in existence which are without volition; so we commence in a similar manner with an inquiry into the natural laws of the voluntary and thinking being, which stand forth still more prominently as laws of Reason, than those belonging to inanimate Nature.

When we have expressed the great truths, that Natural and Divine operations are one, and that the laws of nature are Divine thoughts, we may without fear of misinterpretation be allowed to describe the same object sometimes as natural and sometimes as divine, selecting whichever of these expressions is most suitable to the object in question. In this we do not deviate from usual custom—for instance, we sometimes call the spiritual capacities of a man natural abilities, or the gifts of nature, or sometimes a talent entrusted by God—but while we here affirm, with more than usual force, the spiritual essence of material nature, the justification of the tendencies which stand opposed to this consideration, is brought so much the more vividly to our consciousness.

In accordance with this we say that man is born with those natural capacities which make him a reasonable creature. We may therefore say, man is born for reason, for justice, for the recognition of a God; but all this exists only in those capacities which are developed into self-consciousness by reciprocal influence with the rest of existence. Inasmuch as this is the case with each individual man, so it is with the human race. We only intend here to point out their development as it relates to our consciousness of a God, and our consciousness of duty; developments which partly follow one another, but more frequently take different directions, till at a certain point they flow together, and form one.

So long as the human race remains at the earliest point of

mental development, where inquiring Thought has not yet testified its presence, it is natural for the spirit to imagine something in the external world allied to itself, and hence Heaven and Earth, in the childhood of the human race, become peopled with thinking, feeling, and willing beings. Already therefore, the knowledge of a God, which exists in human nature, begins to appear ; though it is yet but a germ, which must develop itself in co-operation with the other forces of the world ; without these it would be choked by the weeds which grow along with it.

Intercourse with our fellow-creatures is natural to the human race ; indeed, we may almost say that it is part of the nature of a reasonable, sensational being to be a social animal. While he both receives impressions and reinfluences other beings of his own kind, a feeling is awakened of the essential similarity between his own nature and that of those with whom he communicates. A complete series of different degrees of development must indeed be passed through before this feeling can attain its full signification ; let us, however, consider how this development leads to the ideas of morality. For a long time the growth of mutual love suffered continual interruptions, from the fear which one man entertained of another, and the violence resulting from it ; meanwhile mankind at large from time to time either mutually assist or injure each other, and thus there is awakened some conception of good and bad intention, of right and of wrong. However dim these conceptions may have been, still they were the starting points of a series of progressive movements in successive races, which cannot be overlooked. After the existence of long periods of barbarity, in which the social feelings came into contact with the various demands of selfish interests, they attained in one country or another such strength that men combined for mutual help and defence. At this point the idea was called forth, of a certain law and order necessary to their confederation, whose maintenance was requisite for the common benefit. In the progress of that confederation this consciousness is still further developed ; the thought of virtue and duty becomes more and more apparent. Let us not meanwhile forget, now or afterwards, that all these external and internal causes are the operations of the same Eternal and Living Reason by which all is created and sustained. We therefore must confess that this develop-

ment, when viewed merely in a one-sided material light, seems to be a contradiction to our spiritual nature, but that it really obeys the Almighty and Omnipresent Divine will.

We should have a false conception of the development of the human race, if we thought that all men equally contribute to it. There have been some highly-gifted men to whom these ideas first became clear, and who thus were able to express them to the multitude. Such men are generally far advanced beyond the rest in many other respects; they know how to impart many useful truths, for instance the future positions of the heavenly bodies and the course of the seasons; they are therefore looked upon as intimate with those spirits which are believed to dwell in all natural objects, in other words they are regarded as the friends of the gods; they are admired and obeyed. These men, however, have a deep conviction that what they know and impart to others is far from being exclusively the result of their own labours, for their minds have been awakened from without by those natural objects which they have observed and on which they have reflected; and, even their inner mental capacity, by which they have worked out these external impressions, they must regard as a gift of nature and of the gods. They feel themselves as it were inspired, and without deception proclaim themselves the chosen of the gods. In this simple faith there indeed exists a truth, which in later times has been often overlooked; it is the divine agency and government in man and nature, which has obtained a living, though not perhaps a clearly defined, consciousness in their minds. I need hardly say that the human race continues in this way to develop its moral conceptions as well as its knowledge of nature from century to century, and from thousands to thousands of years, and that these ideas and this knowledge are unfolded in obedience to necessary laws of existence by the reasonable works of Nature, namely, by the human race in constant reciprocation with nature and with each other.

This mental growth of the human race is associated with the first idea of a God, but, as in the former case, this is at first of very slow growth. The worship of nature for a long period predominated; but, by degrees, in proportion as the moral ideas of man were developed, they were transferred to their gods. To prove that the heathen divinities were merely natural gods, it has been stated that

many immoral qualities were attributed to them; but this must not conceal the true relation there existed between them. Men bestowed the same moral qualities on their gods, as they themselves displayed; and this they did, it is evident, to each deity, according to their different conceptions respecting the powers of nature he might wield. We must not forget, when considering this subject, that the original myths were formed at a period when there was a very imperfect notion of morality, and when license, rapacity, and cruelty were by no means excluded; as man was, so were the gods who were created by him, in conformity to his rude poetical notions. This original character still remained with the gods, in a subsequent and more polished period, during which, nevertheless, some poetical ideas were added; but at length there came a period when, from the progress of civilization, the gods were in direct opposition to the natural as well as moral conceptions of the age. At first the gods of ancient days were only rejected by the enlightened, but afterwards by the multitude. This manner of proceeding naturally varied with different people; but the principal features were the same in all. We cannot indeed speak with the same knowledge of the period which preceded Zoroaster and Confucius, as of that which preceded Socrates; yet we cannot doubt that there was a great similarity in the course of events.

Natural Science had a great influence on the more advanced conceptions of the recognition of a God, by banishing from the rank of free agents those natural objects which had been formerly worshipped, and submitting them to the laws of nature; for when the car of the Sun-god rolls on without his guidance, the belief in his existence disappears: and so it is with the Moon-goddess, when her silvery light, far from the woods and meadows on which she sometimes pours her radiance, wanders without her guidance: indeed, all the gods will be driven from their mountain thrones, wherever these laws are properly acknowledged.

In the development of the human race there are certain turning points where the mind of man may be said to have attained a new and a higher station; but the most immediate effects of this success are not without important losses to the succeeding period. While old and rooted errors are dispelled, great truths which are connected with them are

almost always, in the arrogance of victory, likewise overthrown, and among the childishly ignorant multitude who have adopted the new opinions, not from conviction but on the word of others, and without any clear connection of ideas, there arises an insecurity of feeling with regard to all intellectual questions; the former ideas of the physical universe are all broken up, and there is a period of license which throws back a people or whole nations, into a depth of error and darkness, from which they are only able after many centuries to disentangle themselves.

These revolutions however, should not hinder us from seeing how Reason and Light conquer in the end; every endeavour to trace the connection of one thing with another, and to comprehend the laws of existence, contributes its part to lead the human race to the recognition of a God even where this was not intended, indeed when such an endeavour had an opposite end in view. All the paths of thought lead at length to a more complete comprehension of the great unity of ideas; although often at first leading away from this, the efforts nevertheless of a multitude of thinkers must be finally guided towards the true centre; for reflection destroys its own mistaken tendencies.

We will force our way to this central point that we may seek in what the unity of all our endeavours consists, in order to find a principle for the lessons of duty and virtue. How well known are such principles as the following: Advance towards perfection, Promote the general good, Follow those maxims which can rise to general laws, &c. We need not name them all, which would at any rate be a wearisome task; it is enough to mention that which is generally applicable, and we shall then find, that whichever maxim we may select for the object of our reflection, although it may be a principle which every reasonable being would be forced to reject at once, it is sure to have a final tendency to regulate our lives according to Reason. None of these principles contain the whole essence of Virtue; but they have still contributed to guide those into the path of reason, who comprehended and obeyed them: for *one* wise maxim of life which is firmly adhered to, compels us, if we do not fall into frequent contradictions, to follow all the maxims of reason so far as we can perceive their connection with that principle whence we commenced. Even the precept, "Promote your own happi-

ness," which in its direct acceptation is both despicable and opposed to reason, will yet require us to lead a life in harmony with reason, if we remember that intellectual pleasure must be included, to form happiness; however, we must allow that this precept is peculiarly subject to be wrongly applied. If the notion of happiness is completely comprehended in connection with the happiness of the whole nation, it then leads to a correct representation of our moral relations when viewed on one side. We must, namely, take into consideration that man, even when he is led away by his passions, and forgets his reasonable nature, cannot entirely dissipate the influence which the reasonable connection of the world must have on him; the evil that he does, and even the evil that he thinks, brings him in opposition with his own nature, and with the whole of existence, however much he may endeavour to hide it from himself. Whatever is sin, in a religious sense, is folly, in a true perception of the world. He then who is thoroughly convinced of an eternal reason in existence, will find that happiness is one with virtue and piety. It is true that it is often very difficult to be practically convinced of this truth, in the face of strong opposing impressions which we meet at every turn, so that the better persuasion is often forced to submit; but this weakness of the human race cannot prevent us seeing in that conviction a powerful support to virtue.

With respect to most other moral systems, that which is most clearly perceptible in them is the requirement that human life should be guided by reason, not indeed according to that of any single individual, but by eternal reason. It is not merely our lives that must be regulated by it, but all our inner being must yield to this reason, and rise along with it; man must feel that he possesses his true spring of life, when he appropriates to himself eternal reason; otherwise his whole life remains but a broken, irrational, miserable existence. Everything which appeals to our virtuous and upright feelings, naturally leads us to a divine life, that is, to religion.

This manner of thinking is at once strengthened by the conviction which arises from the knowledge of natural science. This teaches us that the material world, which before we considered as acting in opposition to reasonable existence, is most entirely incorporated into it; so that the operations of

nature proceed in obedience to a reason which is entirely independent of us, but which nevertheless is the same reason which we should endeavour by means of our free will to realize. We thus know that our life, both inwardly and outwardly, continually grows in more perfect accordance with the whole of existence, the more it is guided by divine reason.

But how can we reconcile this doctrine of the obedience of the material world to the commands of reason with that incontestable truth, that we are frequently inclined to deviate from virtue by our own material nature, and by the impressions of external nature? This truth cannot be denied, but it must be viewed in connexion with another equally incontestable truth, namely, that our own uncontrolled thoughts equally lead us to be in contradiction with virtue. We see, therefore, that this touches on the lot of finite beings, to which indeed we are unavoidably subject, though in no single instance without responsibility. It is the same here as in our endeavours to make use of external nature, especially when these are somewhat complicated; we seldom succeed in so arranging everything in what we undertake that the suitability or relation of some particular parts to the external world does not interfere with the attainment of the highest perfection; but it no less frequently happens that there are mistakes in our thoughts and projects, which cause such imperfections. We therefore see this in the intellectual as much as in the moral world; and that the cause of our errors is not to be found in the material nor in the mental faculty as such, but that its origin dwells in our finite natures.

Is there no opposition between God and the world? Yes; the Infinite is a reality equally with the Finite. We could imagine a man who lived entirely with God, setting aside the consideration in which he must hold the life of other independent beings, the difference to him between God and the world would then have ceased; but no one ever reaches such an ideal: this much only we may say, the more a man strives after this ideal, the more frequently will he be permitted, in sacred moments, to destroy this opposition within him; while in his mental perception he realizes the immediate operation of God in that which is called the world. It therefore follows, that the less a man lives with God in this world, so much the stronger to him will be the opposition between God and the world: yet it must not be forgotten, that even he who strives

most earnestly to dwell with God in this life, must yet always view the world, in a certain sense, as in the greatest opposition to God; inasmuch as he distinguishes, by the term "world," all that in the finite, which separates free agents from Deity; a form of speech which the better deserves to be retained, since it possesses the right of old and sacred usage.

But while we have represented existence as a kingdom of reason, we are again met by a doubt in the question: How is this reconcileable with that freedom of will which permits evil, and consequently irrationality? This must surely have an influence on the course of events in the world! Before we undertake to answer this question, we must remember that this is the principal difficulty in all our attempts to comprehend the government of the world, and of which the Christian Church gives us the strongest example. The purpose of our present enquiry does not oblige us to answer all the questions which may be raised with respect to free will; but only so far as will explain to us how reason may rule on a comprehensive scale, associated with individual freedom of action; and this we will now attempt to do.

So far as man *thinks*, he is free. His freedom grows with thought, and without it, he is subject to the laws of unconscious nature. Man is never an entirely free agent, or a complete slave to nature; he floats between the two extremes, though in very unequal proximity to the one or the other condition. Free activity of thought is only in a certain sense withdrawn from the laws of nature, which are indeed one with the laws of existence. It might appear that the freedom of the individual was opposed to the dominion of universal law; but this appearance vanishes at a nearer view of the case. It is indeed evident that actions are performed under the guidance of free will, which are not only blameable, but also in their immediate effects contradict what would otherwise follow from the universal law of reason. It might thus seem, that from the manner in which finite creatures abused their free will, God was obliged to perform arbitrary actions; actions which lie beyond the eternal order of reason; but we must at the same time consider that as what is contrary to reason in thought, is sure at last to destroy itself, even though it may have claimed a semblance of truth for many ages; so also all that is contrary to reason in the remaining portion

of our free agency, will destroy itself. Thought, in conformity with its nature, must act according to Nature's eternal laws; so that its irrational flights are in opposition to its fundamental essence; and in this there is an attempt to weaken the power of evil in the will itself. Besides this, by the wisdom of the whole of existence with which man is in constant and reciprocal communication, he is required to regulate his thoughts in harmony with this wisdom, so that the conclusions of our free will, though not absolutely perfect, may be in a general manner intermingled with the reasonable harmony of the whole: but so far as the effects of evil disturb the arrangements of reason, they produce counter effects, which in the end destroy the evil. All this follows naturally; but it requires some explanation; we will therefore begin with an example.

Let us imagine a man possessed with a blameable thirst for power. This quality is not essentially worse than any other natural disposition: it generally possesses the capability of ruling and guiding, and consequently of co-operating with reason; but it is also inclined to enforce its own will, and to compel others to obedience, and it frequently degenerates so far as to endeavour to obtain this, if it is not withheld by reason. A harmless love of power may indeed be opposed by the self-will, the prejudices, or the selfishness of some, but is also supported in its efforts to forward the reasonable, by the clearer insight and the goodwill of others; evil is promoted by the servile spirit of many, and even receives assistance from those who expect to be rewarded, when they submit to be tools to the will of the ambitious; it not only meets with opposition from all the malicious hindrances it has itself opposed to virtue, but also from an inward sense of right and spirit of independence in mankind. A strong love of power, if not sufficiently controlled, is sure to commit much error along with the good that it performs, but it is easy to perceive that the forces which assist good actions are in conformity with reason, and cannot, consequently, contain anything which must of necessity be destroyed by time; whereas the forces which assist evil actions are opposed to reason, and therefore are in mutual contradiction both with one another and with all other existing objects. A vigorous power of ruling is a centre of strength, from which proceed various effects, which are more entirely subordinate to the

ruling spirit the nearer they approach it in time and space ; but depart from it and submit to foreign influences the farther they are removed from the centre of action. It is of course understood that these decisions are only the most general and prominent features, and that there must be many apparent exceptions, for which it would be difficult to account, but much will be cleared up if we divide our general example into some smaller branches. One of the strongest expressions of the thirst for power, is well known to be the desire of conquest : it will not diminish the force of those principles which we now wish to bring forward if we acknowledge that a thirst for power is not the only motive for conquest, but that a desire for honour also operates with many other influences. The conqueror will not easily accomplish much if he does not meet with a slackness and remissness in other countries which requires rousing and regulating forces, and this the spirit of conquest brings along with it. It is true that more or less confusion and destruction accompanies the new order of things, but the operations of freedom here resemble those of nature, as in spite of all dissimilarities they must equally work in accordance with the fundamental laws of existence ; if the conquest degenerates into a long oppression, the very pressure and injustice of the deed rouses an energy which is requisite to throw off the yoke, and then the people come out renovated and refreshed from the struggle. Or the predominating power may not encounter a corresponding opposition, and then the victors form a new people in the land, who adopt the most serviceable part of the older forces of the country. The useful forces which the victor has roused, both among his own people and in the conquered nation, and the good laws and ordinances which he introduces, will long endure ; while that which is prejudicial to the world will sink beneath all the opposing forces which it must awaken. We must, however, bear in mind, that centuries form but short periods in the history of the human race.

Despotism, it is well known, almost always accompanies a thirst for conquest, but it may exist independently ; it flourishes only where the mental faculties of the nation in general are either not sufficiently developed, or are weakened by false training. In the latter case, despotism may last a long time ; but if the people themselves have not sufficient

energy to overcome the oppression, foreign powers will accomplish it sooner or later.

Before I proceed, I must remove one objection, which, viewed from a finite ground, is insurmountable, but which loses all its weight when seen from a point whence the whole question may be surveyed at once. Looking only on the finite view, we may argue, what does it avail the innumerable beings who suffer perhaps both mentally and bodily, possibly during life, that the misfortunes which oppress them here will be explained in a higher order of things? This objection is an old one, and so is the answer, but the argument is repeated whenever any one endeavours to exhibit the reasonable order of human affairs, and on that account the answer must also be repeated each time, and especially because every time it becomes more obvious. Above all things, we must remember the present explanation does not pretend to offer any additional proof of that agreement of existence with our conceptions of perfection, which is partly founded on the sensational perceptions, and partly on one-sided reflection. We will merely maintain this important truth, that all which is contrary to reason, will in the end be resolved into the eternal activity of reason in existence, and that the harmony of reason must conquer. We have only to add that objects may exist, which though they themselves are in conformity with reason, may yet possibly, during a certain period of time, be opposed to the general order of reason, and consequently must sink, that they may again arise at the proper season.

We must further remind the inquirer that no system, merely taken from a finite point of view, has yet been discovered, in which evil, whether physical or moral, has been represented as destroyed and resolved into good; for this we must point to a duration of life beyond this mortal existence, and our powers of comprehension cannot dispense even with this advantage. The belief in such a continuous life is indeed natural to us, as will be proved in the sequel. Here we only hold fast to the reasonable connection of all things, whether it may flatter or disappoint our desires.

We must still farther remember that all finite existence is infinitely small in comparison with the whole; and although some of the effects of the abuse and error of free-will may extend through centuries, and even thousands of years, still

the proportion remains infinitely small. No one can deny this truth, but it will perhaps animate and invigorate our knowledge, if it is explained by an example which is offered to us by our globe. Without going farther back than where we may be guided by facts which have been clearly proved, we perceive that our earth must have existed some thousand years before the creation of any organic beings, that more thousands of years must have elapsed during which there was nothing but barren vegetation and soft-bodied animals, that at a still later period there was a succession of eras, each commencing at the downfall of the preceding one; every one of these periods made a fresh step in development, till at last man appeared. What is all the time during which man has existed, compared to these immeasurable series of thousands of years? What again are the individual epochs in the human race in comparison with the whole period of its existence, without even including the time which is still to come? yet we have only taken our own globe as an example; the universe exhibits far longer divisions of time.

The development of the human race has been similar to that of the globe, in spite of the usurpations of free will; which have apparently but a small influence on the course of nature. I have heard it maintained by some theologians who had been misguided by the literal comprehension of some passages in the Bible, that death entered the world with sin, but nature clearly proves this is a misinterpretation, by the evident traces of death, destruction, and pain, before the existence of the human race on earth; and at the same time all researches into the nature of the human body show, that by its original construction, it bears the stamp of mortality.

We must therefore conclude from all that has been said, that the human race develops itself according to the laws of reason, that the series of changes which take place, in spite of many alternations from progressive to retrograde movements, are still an actual development, and that the usurpations of free-will, notwithstanding apparently disturbing influences, must obey the eternal order of Reason. We may add to this, that human reason perpetually develops greater depth of knowledge and more distinct views, and thus is armed with greater power to avoid mistakes. In short, we may happily rest assured, that all those entanglements which befall the human race, and which seem somewhat threatening

at the present time, cannot prevent us from perceiving that the race of man more and more approaches the realisation of a kingdom of reason upon earth, though of course subject to those limitations which must accompany a finite existence.

We return to survey once more the reciprocal influence of reasonable creatures on earth. The mental development to which every inhabitant of earth is subject, is the united effect of his own action, and the influence of the surrounding world, in which his fellow-creatures usually occupy the most essential portion. No single man could have developed all the knowledge and learning which the human race as a whole has produced; indeed, human life is not long enough to accomplish such a task. The highest degree of mental cultivation which a man can reach is the capability to penetrate thoroughly a limited circle of knowledge, and by aid of the intellectual development thence attained, joined to an eager love of inquiry, to gain a tolerably clear image of the whole of existence. With respect to much which he is not able to acquire by his own investigations, he must rely on that of the rest of the human race; he must receive the information as a gift from that reason which pervades the whole of existence. It is a light which permits him to perceive that which is concealed in the fathomless depths of his own being. His apprehension and acquirement is, in that case, a faith. This expression must however be understood with more or less meaning, and we must only use it in the latter sense as connected with those truths which relate most intimately to the essential principle of our existence. We cannot draw any defined limits here; for the higher a man has raised himself to a really true and natural mental development, so much the more means has he at his disposal to strengthen his belief in truth; he is indeed often enabled, by this, to change that into knowledge which must remain faith in others; and even where he is forced to abide by faith alone, he can raise it to greater distinctness and power by confirming himself in the remaining truths which he is conscious of. In all our mental efforts, we must endeavour, if we would not wander from the right path, to preserve our natural love of truth in its entire purity; for our inclinations often tempt us to adopt that which flatters them, for truth. Amidst the temptations which most easily gain ground among those who would be teachers and guides of the human race, is the pleasure of

saying something extraordinary to our fellow-creatures, something which draws admiration on the speaker.

All the distinct and simple truths in man, as we have seen, are revelations of Eternal Reason. He therefore who discovers and declares them, is so far an instrument in the hands of God. In as much as the revealed truth is higher, more comprehensive, and more exalting, it is proportionately supernatural in comparison with that finite condition which at a lower estimate is exclusively called Nature, although it is perfectly natural in the eternal nature of God. One external sign of the exalted nature of this revelation is the vastness of its operation; vast, let it be observed, not merely by its great extension through the world, but in the amount of the effect which it produces in the human race itself—the improvement, the exaltation, the nearer approach to God, of which mankind thus becomes conscious.

The chief intention of what has been said of the relative conditions of free will was to show that all the free beings on earth are intended to form a kingdom of reason; and that this is a natural consequence of the plan of nature now existing, but which yet must be carried to greater perfection by a continued development: all that I have said beyond this was merely added to prevent misunderstandings. It is easy to apply this now to the rational inhabitants of other worlds; they are formed according to the same laws as the inhabitants of our globe, they must therefore be mortal in the same sense as men; they must all, in conformity with their existence, have a commencement in their own appointed time and place; they must be subject to the impressions of their surrounding world, and, therefore, be conscious of what conciliates or opposes their wills, that is, they must feel pleasure and displeasure; they must begin their sensational existence with a capacity for reasoning, and must feel themselves impelled to develop this as well by natural inclination, as by the rousing influence of the surrounding world. Every other free being must receive impressions, some in opposition to the will and inclinations, and others agreeing with them. The contest with the rebellious will must develop laws of will which do not indeed absolutely compel, as the laws of nature, but at the same time demand that certain maxims of reason should be realized by independent efforts. They can no more all be created with equal capacities than mankind

on our globe, for the existence of every individual begins under different conditions of time and space. Thus, as on our earth, the most highly gifted will there also form a ladder for their fellow-creatures, of greater or less compass according to the capacity of each. They must feel that they are urged by a common natural impulse, and by a common need, to conquer the acts of involuntary nature, by common desire to comprehend existence and to act in common; in short, the principal features in their mental being must accord with that which we recognize in all free natures on earth.

When we have gained a clear conception of this essential unity in the moral world, we may venture, though very cautiously, to make an attempt to develop still further this fundamental view. We may be easily led, in such an attempt, to transfer the peculiarities of our own earth to the rest of existence. When I spoke of the essential unity of the faculty of the understanding, that which I said of the possible wide distribution of different forms of existence, although possessing one fundamental nature, may also be applied to this. Let us only remember the various stages of development in which we find the human mind, owing to the different conditions of existence on our earth. But what are these dissimilarities of condition when compared to those which exist in all the planets! amidst those innumerable worlds there is every possible dissimilarity with regard to age, light, radiation, &c. Our tolerably exact knowledge of the dissimilarity of these conditions is limited to an inexpressibly small part of the whole; its application, therefore, to the results of those intellectual forms of existence which are determined, must be still more limited. The variety in the nature of the planets of our own system is very great, but if we extend our thoughts over the whole universe the differences are endless. On some planets the creatures may possibly be on a far larger scale, on others far smaller than our own; on some, perhaps, they are formed of less solid matter, or may, indeed, approach the transparency of æther, or, on others again, be formed of much denser matter. The rational creatures on some of the planets may be capable of receiving far quicker, more acute, and more distinct impressions than on the earth, and on others it may be quite the contrary. If we now turn to the mental forces and mental development we cannot acknowledge less variety; we may

Imagine that there are reasonable beings with weaker faculties than ourselves, but if we properly appreciate our present distance from the aspirations of our reason we feel compelled to acknowledge that an endless number of degrees of development may exist above the point we have reached. Yet we must not be depressed with this reflection. Our race is still in its youth on earth, and seems to have a long futurity in prospect for higher development, and we may venture to hope that those who have fulfilled their appointed path on earth in the season which was allotted them, may yet have an opportunity elsewhere to rise to a still higher summit.

On the Intercommunication which exists between the Planets.

WE have seen that the inhabitants of our planet possess some knowledge of the condition of other planets. With regard to the moral government of other planets, we limited ourselves to prove that the essential principle on which it rests must be similar to ours; but to say anything determinate of the peculiarities which each may separately enjoy, is beyond our power. We were less limited as to our knowledge of the natural laws; we can determine the period occupied by a year on each of the planets in our system: and on those best known to us we can pronounce the length of their days, their solar and lunar eclipses, the velocity of falling bodies, the path described by projected bodies, their density, the amount of light which they receive from the sun, &c. Just as we are able to know this of other planets, we must suppose that the inhabitants of other worlds are capable of understanding our condition. The inhabitants of those worlds who possess higher faculties than ourselves, or who have made greater progress, may naturally know more of the condition of our planet than we are able to know of them; but we shall not remain content with the knowledge we at present possess of the condition of other planets. We will transport ourselves in thought three hundred years back, before the knowledge of the Copernican system was spread. What would then have been said of any one who could have imagined the truths of other worlds at that time unknown, but of whose existence we are now certain? What would have been said of him who believed that the planets were worlds like our own, with periodical years

and days? What would have been thought of him who could have prophesied that a time would come when mountains would be discovered in the moon, their height measured, &c., &c., and that maps of such exactitude would be taken of that side of the moon which is turned towards us, that in some respects they surpass those we possess of the surface of the globe? What would have been thought of him who ventured to maintain that the fixed stars were distant suns, of which many must be much larger than our own sun? Would they not have been regarded as dreamers? No, we may say, not by all. Some few even in ancient times participated in this knowledge, although not supported by all the reasons which we now possess to prove its truth. Certainly a few recognised it, but hardly one in a million; the great mass, even among the enlightened, ridiculed these dreamy thoughts, so far beyond the customary range of knowledge. Must we not expect this to happen in the present times, under similar conditions? We cannot wholly escape it, though perhaps we may expect milder treatment, after the greater experience we now possess of the power with which discoveries occasionally overleap the boundaries which formerly were deemed the extreme limits of human knowledge. No one will deny that we are still far removed from that knowledge of the structure of the universe which it is possible for us to attain. If we consider the constant addition to our means of discovery, and how one branch of science supports and strengthens another, we are then sensibly impressed that the limits of knowledge are still far distant. Tycho Brahe neither possessed the telescope, the astronomical clock, nor the micrometer. Even a century after his time telescopes were very imperfect instruments when compared to those we owe to Dollond and Herschel, and these again have been far surpassed, especially by those which Fraunhofer and his successors have produced. Clocks and metrical instruments have been brought to such perfection, that they seem nearly to reach the limits of what is attainable; but astronomers are endeavouring, and with justice, to aim at something still higher, because they know that even this small attempt might yet lead to much which would otherwise be unattainable. Science has received great support in another way by the immense increase in the number of her labourers, and from the far more perfect foundation of knowledge from which they start. Finally, astronomy has been

very much aided by the progress of other branches of natural science ; thus geology, for example, has enabled us to form conclusions as to the internal structure of the planets ; our increasing acquaintance with the magnetism of the globe gives us a prospect of understanding that of the other worlds. The constant progress in our knowledge of the nature of light and heat will in time make us acquainted with a variety of conditions hitherto concealed on distant planets. Yes, it is possible that at a very distant period, we may attain such an accurate knowledge of the organic laws of our globe, that some of this knowledge may be applied to the organizations existing in other worlds. I know the chasm is immense, but in the meanwhile we must consider what wonderful progress has been made in our knowledge of the laws which govern the animal creation during the last half century. The connection which subsists between the present animal kingdom and that which disappeared in the course of several thousand years, and the unity of the laws by which we can comprehend them, give us hopes that one day we shall be able to point out the conditions under which the animal and vegetable kingdoms have been successively developed, as well as the conditions under which certain forms might exist which have never yet been realized. It is indeed true, that from our present knowledge to the knowledge of organic beings on distant planets, where not only there may, but there must exist entirely different matter from that on our earth, there is apparently a gap which cannot be filled ; but Chemistry alone will in time teach us general laws for the formation of matter, by which we shall be enabled to form conclusions of what happens in other worlds.

We, therefore, hope in this world to be continually gaining more and more knowledge which will give us a much deeper insight of what happens on distant planets and at the same time will enlarge the sympathies of our spiritual existence with the whole of the Universe. If we now imagine that the same thing happens on other planets with regard to us, we must perceive that there is an arrangement in finite existence by means of which one part of the universe may comprehend the other by its mental faculties ; that, consequently, each essential portion of the universe may recognize the whole ; even that every one may possess a knowledge of the Knowledge, the Faith, and the Recognition of a God in other worlds ; in

short, that the whole of existence is not alone, by origin and by the guidance of the eternal, all-powerful Reason, a kingdom of reason, but that there is a disposition towards a community of reason in the finite thinking being itself, a disposition which, among the inhabitants of the earth, has hitherto only reached a certain degree of that development which is desired, but which, probably, has already reached far higher perfection in some other parts of existence. It therefore follows from the nature of things, that we may say, in the most comprehensive meaning of the expression, that the whole of Existence is a kingdom of Reason.

THE CULTIVATION OF SCIENCE

CONSIDERED AS AN EXERCISE OF RELIGION.

An Address delivered at the Festival of the University commemorating the Lutheran Reformation, 1814.

I have been induced to print this short address, because it includes many of the ideas which are more fully developed in other parts of this book, and also as it enables me, from its brevity, to place their unity in a stronger light. In everything essential, I have printed it as it was originally delivered, since it may be useful to compare the views of an author on subjects closely related, which have been written during a period of thirty-five years. I must observe, with respect to that part of the address which is specially applicable to the circumstances under which it was delivered, that the festival was formerly not only, as at present, a commemoration of the religious improvement and the reforms of the University, under Christian III., but it also commemorated the inauguration of the new academicians. The speech was delivered in the Latin language; I, however, communicated it in Danish, in Molbeck's Athenæ for February, 1815.

By the laws of our learned society the task has devolved upon me to-day, to recall to your minds the happy revival of the true faith in our country. However beautiful and inspiring this subject is I should still shrink from it, conscious how much I am wanting in the gift of eloquence and in the practice of public speaking, if a holy duty did not urge me to come forward. This duty, however, secures me the most indulgent sentence from you, so that here, as elsewhere, the consciousness of doing right gives the courage to perform it.

When under the influence of religious gratitude men meet together to celebrate the establishment of the empire of truth, it seems to me we should remind one another that this empire, although in itself eternal and indestructible, may be lost to us if we do not watch it ourselves with conscientious zeal, for man is continually in dread of his own weakness. No sooner is one error overcome than another, which we imagined was

buried in oblivion, rises up again, and human nature is so feeble and so fickle that most people turn directly from the extreme of one error to the extreme of the other, which formerly was the object of their hatred and contempt; and pass over the firm centre of truth, despising that pure light from which, nevertheless, all the glittering colours of error have borrowed their lustre. Suppose, for instance, there was a period in which the development of Science was hindered by the foolish idea that it endangered faith and piety, many would not become conscious of this error without falling into the opposite fearful opinion that Religion, as the eternal enemy of Reason, must be extirpated; but hardly would the adherents of these opinions become ashamed of their godless frenzy, than the previous dread of science would be again expressed, and partly, indeed, by the very same people who, formerly, clung zealously to the opposite error.

We pity those only for their own sakes who allow themselves to be blown about hither and thither by the gust of every opinion; but, for the sake of mankind, we bewail the many excellent youths who with enthusiasm for everything noble and good, have not yet surveyed the world and its opinions in a true light, and who only resign themselves to the one error because they so keenly feel the enormity of the other. It is this distrust of reason, that light which God has given us, which has latterly led away so many people, and some of them noble minds, to exchange the freedom of Lutheran Christianity for the priestly servitude of the Romish Church, an error whose existence happily we may principally seek for from abroad, though we have sufficient grounds at home to oblige us to strive earnestly against it.

Under such circumstances it will not be foreign to our purpose if, called upon by the solemnities of this day, we endeavour to establish our conviction of the harmony that subsists between religion and science, by showing how the *man of science must look upon his pursuits, if he understands them rightly, as an exercise of religion.*

If my purpose here was merely to show that science necessarily engenders piety, I should appeal to the great truth everywhere recognized that the essence of all religion consists in love towards God. The conclusion would then be easy that love of Him from whom all truth proceeds, must create the desire to acknowledge truth in all her paths, but as we desire here to

recognize science itself as a religious duty, it will be requisite for us to penetrate deeper into its nature. It is obvious therefore that the searching eye of man, whether he regards his own inward being, or the creation surrounding and encompassing him, is always led to the Eternal Source of all things. In all inquiry the ultimate aim is to discover that which really exists, and to contemplate it in its pure light, apart from all that deceives the careless observer by only a seeming existence. The philosopher will then comprehend what, amidst ceaseless change, is the Constant, the Uncreated, which is hidden behind unnumbered creations, the bond of union which causes things not to fall apart in spite of their manifold divisions and separations. He must soon acknowledge that the independent can only be the constant, and the constant the independent, and that true unity is inseparable from either of these. And thus it is in the nature of thought that it finds no quiet resting-place, no pause, except in the Invariable, Eternal, Uncaused, All-causing, All-comprehensive Omniscience.

But if this one-sided view does not satisfy him, if he seeks to examine the world with the eye of experience, he perceives that all those things of whose reality the multitude feel most assured,—the Material,—never have an enduring existence, but that they are always on the road between birth and death. If he then asks himself where the *Constant* is, reason and experience answer in one voice, that it is only in the powers which produce things, and in the laws by which they work; the powers resolve themselves into one fundamental power which expresses itself in two opposite ways, and, on a closer investigation the laws appear as the one reason which pervades and governs all Nature. If he now properly comprehends the whole harmony of Nature, he perceives that it is not merely an idea, or an abstract notion, as it is called, but that reason and the power to which everything is indebted for its essential nature is only the revelation of a self-sustaining, living Omniscience. The Constant in nature is derived, therefore, from the eternal, self-sustaining Being; the indications of life, from that which possesses life; the connection and harmony of the whole, from the only perfect wisdom. How can he, when he sees this, be otherwise animated than by the deepest feelings of humility, of devotion, and of love? If any one has learnt a different lesson from his observation

of Nature, it could only be because he had lost his way amidst the dispersion and variety of creation, and had not looked upwards to the eternal unity of truth.

If we now attempt to soar aloft upon the wings of the spirit which, feeble though they be, were yet given to mortals to raise them from the dust; if we venture, although with a deep feeling of our immense inferiority, to raise our eyes towards the All-perfect One, that we may penetrate as far into his Being as is permitted to our limited faculties, three fundamental attributes or principles present themselves to us.

His *Independence*; how he essentially originates from, and relies upon himself; this as the incomprehensible foundation must be first named. Inseparable from this is his *Activity*, which, differently expressed, may be called his life, whose essential nature is this, that through its eternal self-representing power it produces itself from eternity. Finally, from both of these proceeds the inward *Harmony* of the whole essence, which is not only an attribute, but a living, acting being.

It will be unnecessary to mention to an enlightened audience, that this conception is not merely an adaptation to the doctrine of belief now prevalent, but that it has been already exhibited in a former age in that philosophy which aspired most earnestly towards the Eternal Being. It is, therefore, not borrowed from our holy religion, but has received its strength from it; therefore we may with more confidence follow this gleam of light offered to us by reason.

From the point of view to which we have raised ourselves, we can now understand the deep feeling of something divine, by which we are penetrated at the contemplation of the *Beautiful*. We understand this word here in its widest signification, in which it at once comprises the Sublime, the Inspiring, and the Harmonious. There is that in the Sublime which rouses the thought of independence, an idea which is not only called forth in our souls by mental determination, and by an elevation above all that is little, which the world generally values so much, but just as often by the contemplation of material objects, for instance, of a mountain towering to the clouds; of an oak which has braved the storms of centuries; of the ocean which, embracing all countries, encircles the globe; in short, by objects whose stability, indestructibility, or magnitude, take possession of our souls.

But the soul will never be carried away by any contemplation of beauty, unless a mighty creating power of action is at the same time revealed. It is only thus that our whole being is at once kindled with new warmth of life, and penetrated with that divine power which is so truly and so beautifully named Enthusiasm and Inspiration. Lastly the *Harmonious*—which in a more limited meaning of the word is called the Beautiful—consists in that impression of a hidden, unfathomable reason which, uncomprehended by the understanding, is grasped by the force of the imagination.

Thus Man is led to God, the Eternal Source of all things, whether he may have sought to investigate the essence of *Truth* or *Beauty*, especially that which necessarily belongs to the nature of *Existence*.

If he now wishes to know what it is which he must freely strive after, the first answer of the natural understanding of man is, the Good. But he sees men at variance with one another, at variance with themselves, in what this much desired good consists; he will soon be aware that almost all the good things which we endeavour to obtain in life, are not valuable in themselves; and that those who thoughtlessly strive after them, could they be induced to answer connectedly what they consider the most important business of life, must confess that all outward goods, among which riches take the first position in the opinion of the multitude, are only sought after for certain ends. These things are therefore not good in themselves, but only because they serve for the acquisition of a higher good. The thinking man seeks an independent good;—a good that is excellent from its own nature, and not from any foreign virtue; but that which is essentially its own is indeed perfect, self-sustaining, independent—is one with the Eternal Source of all things—is God himself.

As everything only so far possesses a reality in as much as it participates in the power of the divine nature, so only thence does it derive its true value. To strive after the good is therefore only to endeavour to appropriate as much as possible of the divine nature. Science tells us, consequently, what the friend of religion must desire, that the right way to strive after the good is the worship of the Almighty.

It is easy to perceive that our code of morals, viewed in this light, becomes religion, while it is its highest principle,

that *with God before us we should endeavour to preserve as perfectly as possible his image in our hearts.*

We imitate the unconditional Independence of the divine nature by the firm determination, never to allow our spiritual being to become the means of attaining a foreign end. Here, as everywhere, the firm centre of reason lies between two evil, irrational, extreme antitheses; egotism sinks into the one, and treats its merely finite character as if it were the real self-sustaining power; while those of weaker minds, who with a servile spirit yield their wills to the arbitrary purposes of others, fall into the other extreme. We imitate, although feebly, the ceaseless creating power of the divine nature, by an activity which endeavours to impress the stamp of the spirit upon everything that surrounds us; to do which we must be as far removed from idle inaction, which debases mankind, as from an inconsiderate or hurtful waste of power.

The inward harmony of the divine nature in its independent contemplative existence, is called *Reason*; in its activity, *Love*; but both are essentially inseparable; the name of both in their entire union is *Wisdom*, in the highest and most comprehensive sense of the word. In this sense Justice also belongs to it, which we may define as the recognition of the same independence in other rational beings as in ourselves; *the Love of our fellow-creatures*, whose essence consists in actively showing that we recognise the image of God in other rational beings as much as in ourselves; *Patriotism*, which unites the two former virtues, considered with reference to the harmony of society; *Veneration for Nature*, so far as this is acknowledged to be the work of infinite wisdom. These are the manifestations of wisdom, which relate to the outer world. If we turn our attention inwardly, it is evident that wisdom must love herself, in her independence, as Truth; in her active principle, as Science and Art; and in her harmony, as a republic of Learning.

The limits of this address are far too narrow to develop this subject, but for our present purpose it is sufficient to point out how applicable is the justice of the old saying, that truth proceeds from God; and that our love of the Divine Being includes a love of science and art, which are only acknowledgments and demonstrations of his nature. We now perceive that we must endeavour, according to that same love, and the love of our fellow-creatures, which

springs from it, to spread that knowledge still farther to whose attainment we were impelled by love. We can now conceive the enthusiasm with which the labourers in science have risked all that man otherwise holds dear and precious, to discover truths whose value could alone be understood by the purest love of truth ; and from this point of view nothing is more evident than this great experience, that in the earliest period of the first development of science, and in its greatest purity, it has always been in the closest connection with religion, a connection which could only be temporarily interrupted by wandering in one or the other direction.

The laws of art themselves which we make use of in the practice of science, that its truths may be *fundamentally* proved, *clearly* explained, and *systematically* connected, here receive a higher signification, so that we may safely maintain that it is our true duty, I do not say to attain, but to endeavour to reach, this perfection. The independence of Eternal Reason in science is testified by this, that all things are made to rest upon the knowledge peculiar to reason, and in such a manner, that every truth must be carried to its most immediate foundation ; that is, that we are not alone contented to find one ground of conviction, but we also seek out the true foundation for the existence of all things that require a proof. The active principle, or the life, which we have called the second attribute, is thus preserved, so that truth is represented with that clearness which is the actual operating power of truth, as it is that of light. Harmony is at last attained by truth, through that intimate and justly proportioned alliance, which we would rather call accordance. The agreement of perfect reason is again shown when we perceive how each of these virtues when it has attained perfection carries along with it all the others, so that the one cannot be thought of without the other ; for if every truth was grounded on a correct chain of thought, it would then be clearly defined and in its proper position, and in the same manner the perfect clearness and the perfect accordance would include the other virtues. On the other hand, with our limited faculties, we can only attain these virtues in a high degree in so far as they are sought in company with the others.

I was not afraid that you would accuse me of having allowed myself to wander too far in a train of thought, when I maintained that the search after perfection in science and in art,

which has been just described, might be designated as an exercise of duty. How could I fear this, in such an assembly of the worshippers of science; among whom there are so many who have themselves made researches in the higher inquiries after truth? Who, in the development of an important succession of truths has not felt it to be a conscientious duty to himself or to others, to attain that perfection of which I have been speaking? But I repeat it again, that it is not possible for the scientific man to attain it, but only to wish to attain it.

But have I not here proved more than I intended? have I not proved by this that all men should be men of science? and have I not thus contradicted an innate feeling, which cannot be opposed without subjecting all the conclusions I have arrived at, after many reflections and conclusions, to suspicion? My answer however is easy, for misapprehension alone could thus explain my words. We have seen, that from the position we have chosen, there are many duties incumbent on all men, though in very different degrees, and each with regard to the particular situation in life which he may hold; for the maintenance of mental independence requires that each man should choose a particular sphere of action, and his feeling for the harmony of the whole bids him select that one by which he can most contribute to the perfection of the whole.

Whilst therefore most people labour in various directions to impress the stamp of reason on the material world surrounding them, and others exert their powers to maintain social independence, inward activity, or harmony, the real labourer in science chooses knowledge as his highest aim. A love of knowledge, which some are frequently obliged to place secondary to other duties, with the man of science must be the occupation of his life; he is destined to nourish the holy flame of wisdom, which shall diffuse its rays amidst the rest of mankind; it is his nightly lamp which shall enlighten the earth. Woe to him if he does not consider his vocation to be a voice from heaven.

Let this feeling of your high calling be deeply impressed upon you, my young friends, who to-day are to be received as members of our scientific union. It is only the conviction that while you devote yourselves to science you are at the

same time honouring God, that will enable you constantly to preserve the courage and the power which your calling requires, and which you will fruitlessly seek in incentives from without.

Each of you who have deliberately chosen the path of science must have felt that riches, whose glitter is so alluring to most people, must not be the highest aim of your endeavours; for it is too evident that this road leads least of all towards that idol of dazzled mortals. Many among you will perhaps find a richer reward in honour, by which I do not mean that of the moment, but that which carries a name over the waves of time to distant races; and it is not to be denied that in a certain sense we may say, with one of the most glorious and most religious poets of the past century, (Jean Paul) "that immortal fame is a grand thought, that it is worthy of the toil of the noble-hearted." But if the immortality of a name were not borne up by a higher hope of immortality, if it were not an earthly type of an eternal life, what would it be but an empty vision, a shadow coming from no body, a rainbow without promise, which revealed no higher light through the drops of earthly matter. No, my friends, nothing but the conviction that our love of knowledge is an endeavour after a true reality, and that it is true life, and true harmony, can give you a genuine, enthusiastic love of wisdom. The conviction that when you diffuse knowledge you are instrumental in the consolidation of God's kingdom on earth, can alone give you a true and unalloyed desire to lead those around you towards a higher light and higher knowledge.

This, my young friends, is the important vocation for which you have begun to educate yourselves. Continue your endeavours with holy seriousness, and you will become capable of participating in a joy which the world cannot bestow, and your works will be a blessing to your Fatherland; yes, and will confer a benefit on the whole human race.

THE RELATION BETWEEN NATURAL SCIENCE AND POETRY.*

A BOOK which intends to produce a change in the comprehension of the world, usual at the present period, must expect opposition; not alone from him who is unable to alter his former mode of thought, but also from many a highly-gifted man, who does not feel convinced of the validity of the new direction of ideas; for even should the author have been so fortunate as to be in the right in all essential matters, we may be sure that in many individual facts we shall find that he has not escaped falling into error; and it is still less possible that he can have throughout expressed his thoughts with such perfect clearness and with such entire consideration of the doubts which might be raised against him, that it shall satisfy every reflecting mind. It is a fortunate circumstance, not alone for the author, but, what is of still more importance, for the distribution of truth, when he is openly opposed by a highly-gifted, learned, and generally respected man. A contest may then be carried on worthy of truth, which becomes important to those who follow the inquiry with attention. It is in this sense that I welcome the remarks which have been made by my respected friend Bishop Mynster against my work, "The Soul in Nature." I shall endeavour to meet this critique, which everywhere bears the stamp of the intellectual and acute mind of the author, with the most earnest love of truth, and with the warmest desire to place all which I hold to be truth, in the clearest light.

There is no doubt that it will be agreeable to my readers, if I tell them at once, that there is by no means so much disagreement between my respected adversary and myself, as he imagines. This is especially the case with regard to the

* The remainder of this volume appeared some months later than the preceding papers, and was published in consequence of a criticism made on the former part by Dr. J. P. Mynster, Bishop of Seeland, in a pamphlet entitled "Remarks on the Soul in Nature," which has appeared in the *New Theological Journal*, vol. i, p. 291-395.—*Tr.*

poetical, which, with a nice sense of what is just, he has chosen as the first point of his observations.

If my comprehension of the world were to produce such an effect on poetry as he assumes, my whole book would, in many respects, have a very different meaning than, in fact, was intended. My views are stated in the critique already cited as follows.—p. 292.

"The author is of opinion, namely (see p. 71), that the progress of Natural Science, and the universal distribution of the knowledge appertaining to it, has rendered a great number of ideas which have been made use of by poets, not only useless now, but must also make them so in future, and drive them back into the poetry of past days; but he also considers that science offers a rich compensation to poets for this loss, if they will only understand how to appropriate it to themselves."

The opinion here attributed to me is very far removed from that which I in reality hold. This may be perceived in the following passage of my own writing. (See p. 72, "Therefore natural science," &c., to "past days.")

From this it will be seen that I was not of opinion that natural science ought to render useless a *great number* of the ideas which poets employ; but, on the contrary, a very small portion of them. The words I have quoted are sufficient to prove this; at the same time it might be supposed that in the connexion of the whole, it would appear that my opinion had embraced more than I have here expressed. That such is not the case I will now show. The examples which I cited of ideas which could seldom be appropriately used in poetry of the present day, do not consist in sensational apprehensions, but in *opinions* of things. Not alone the poet, but often the orator, indeed not unfrequently the scientific author, may employ the purely sensational apprehension of an object. This is already shown in the example introduced in the lines that have been just referred to of the rising and the setting of the sun; but some further examples will make the case still more evident.

The heavens do not really form an arch, but in conformity to the laws of nature, they are exhibited to our external senses as an arch, we can therefore make a very extensive use of this idea; but 'the firmament of heaven' refers to a view of the heavens as a fixed arch, borne on pillars, &c. This is an opinion, and not a purely sensational perception.

Were any one to assert that the invariability of the heavenly

difference between an opinion and a sensational apprehension

arch rouses a sensational idea of something fixed, I would remind him that this arch, in the course of every cloudless day, exhibits a great variety of form—an entirely different one by night than by day; but were he still to maintain his opinion, I should be forced to confess that to him my example would be useless. The idea that the sky is a fixed arch appears to belong to the most ancient times; at a later period it was imagined that there were eight heavens. ~~It appears to me that this idea is also the ruling one in the Bible;~~ yet I must observe that the Hebrew word “rakiah,” which is translated in our Bible as “firmament,” according to the explanation of competent judges, comes nearest to the meaning “extension.”

We are of course not treating here about the correct translation of the expression, but on the employment at the present period, of a thought of ancient days.

If the sensational perception is kept within certain limits, we conceive the surface of the earth to be level, and thus, not alone in poetry, but also in many scientific combinations of ideas, we may speak of the surface of the earth as if it were flat. But if any one says that the earth has four corners, ~~they express an opinion,~~ and not a sensational perception. The expression may, perhaps, within certain limits, be used to distinguish the four directions of north, south, east, and west, but it is hardly ever the most appropriate expression.

The idea of the foundation of the earth is again an opinion and not a perception. We scarcely ever understand by the “foundation of the earth” its centre, as is assumed in the Remarks; but those who first made use of this expression surely meant that the earth rested on a good foundation, like a well-built house; if this had not been the meaning, the “pillars of the earth” would not be mentioned in different passages. At a certain stage in the development of man, this idea, little as it can bear a close examination, is yet perfectly natural; but now, indeed, we are all of one opinion that the earth does not rest on any foundation at all. If it were said that the expression might still be used, as a sensational image, I answer, that this may sometimes be the case, but only when we speak to men who are ignorant that the freely-moving earth wanders in her path without coming in contact with other bodies, or we must speak to

those who do not think at all about the matter ; but to an imagination possessed with a living and present image of the system of the world, the expression "the foundations of the earth," is no better than to talk of the foundation of a well-suspended lustre, or, if possible, it is still less appropriate.

All this does not prevent us from discovering the Beautiful and the Sublime in those passages of the Bible, where the thought of the foundation of the earth is employed, for here it has no reference to the opinion concerning it, but to the thought that God has given the earth her place, and preserved her fixed in the same. "That the position assigned to the earth does change, has nothing to do with our present question, because it is still God who gives the earth her proper place in the heavens. For, indeed, in the same Book of Job, where (in chapter xxxviii, verse 4) God, as it were, asks Job, "Where wast thou when I laid the foundations of the earth?" and in verse 6, "Whereupon are the foundations thereof fastened? or who laid the corner-stone thereof?" and in chapter xxvi, verse 7, it is said as a proof of the greatness of God, that he "hangeeth the earth upon nothing."

This seems entirely to confirm the method I have followed in comprehending such passages of the Bible. If we read the Bible rightly, we must transfer ourselves to the times there spoken of, and be willing to forget the knowledge elsewhere obtained. Yes, we even do this with more worldly objects; for instance, we forget the enlightenment which rejects the belief in witches and ghosts, when the poet carries us back to the period or the circumstances to which they belong. It is easy to perceive that the preacher may also make use of the old Biblical expressions at the present period, without any danger of being misunderstood; for his auditors or readers transfer themselves with him to a time in which later opinions retreat into the shade.

I will yet add an other example to show how little scientific knowledge ought to lower our feeling of the exalted impression which the Bible gives us of God. When David says, in Psalm xc, verse 2, "Before the mountains were brought forth, thou art God," the expression is far too small for pure thought; but for the senses, it has a much more comprehensive magnitude than many far greater images.

David, who has himself so often used grander representations, did not consider it too small, because, to our senses, almost imprisoned in the finite, it so nearly approaches the idea of magnitude. It is impossible to assume that David made use of this expression from a want of penetration, for besides the far more sublime words to which we have just alluded, many other exalted expressions in the Psalms must occur to us. No thought was too high for him who says in verse 4 of the same Psalm, "For a thousand years in thy sight are but as yesterday when it is past, and as a watch in the night."

From all this it may be seen, that it is not our intention that Science should forbid the Poet to employ real sensational expressions, though not scientifically true; but we would only advise that there should be certain limitations in the use of such opinions which might have a charm for the imagination, but which yet are false. Should my views with regard to these limitations not appear clearly defined in the whole connection of my book, they will not now, at least, after the present explanations, be easily misunderstood; but yet, to be quite secure from a misunderstanding which might be greater than would appear at first sight, I will still add something more. The Poet, in my opinion, must only so far avoid ancient and false opinions which have been adopted in poetical language, when he speaks as a man of the present day; and we shall not find these opinions very numerous, if we consider that the ideas which are awakened by the immediate impression of the senses, are by no means classed with them. Science cannot certainly forbid the Poet to make use of these false opinions; but she may tell him that the more true scientific education is spread—which is very different from strict science—so much the more will these false opinions weaken or destroy the character of his work. It will also spoil the impression which is produced by such a work. Thus, for example, in an intellectual poetical composition, the idea of an evil spirit who is in possession of Solomon's ring, and can raise storms and spread wild devastation over the earth, and of a good spirit, on the other hand, who can produce the opposite effect, can make no impression on that man who is acquainted with the laws of Nature, because the impossibility of it stands clearly before his face.

It is true, indeed, that in certain poems we submit to the greatest impossibilities; but then we must be carried to a world where we entirely forget the Natural; if Nature herself approaches us, the enchantment ceases.

If I have mentioned some poetical works, in which the supernatural and the natural appear to be placed together in too great juxtaposition, I willingly grant that it is possible that I may be wrong here, although for my own part I retain my own opinions; but I do not here lay so much stress on the correctness of this judgment, as on the principle that poetry will lose its effect on men who have received a true scientific education, if the Supernatural and the Natural are placed directly together.

I have also blamed the daring manner with which some poets have caused the Supernatural to appear in opposition to the Natural. The way in which Schiller's poem, "The Gods of Greece," has been mentioned in the Remarks, permits me to explain this, and many other points in my expressions, with regard to the relation of poetry and science. With reference to our present object, I divide Schiller's poem, "The Gods of Greece," into two parts; the first, and the greatest, in which he allows himself to be carried away by the glory of the ancient times of Greece; the second part, which comprises the four last stanzas, in which he complains of the present time.

The first part is a glorious inspired expression of a poet's tone of thought, in which he resigns himself entirely to the beautiful Grecian poetical world, and he is fully justified in omitting all that would lead us not to wish those days to return. The second part may certainly be viewed as a continuation of the same poetical theme; but here it turns antagonistically against the present time, not against its errors and mistakes, but against its religion and science. I agree with the opinion maintained in the Remarks, that Schiller's thought, in the antagonistic expression of the poem against Christianity, was probably directed against a soulless comprehension of the Unity, and the transcendent nature of God; and I must add, that I think it is the same with regard to his expressions on the laws of nature; but it is certain that, by the manner in which he has expressed it, he has given room for misunderstanding. Let us read the last part:—

All those blossoms, late so fair, have perish'd,
 Scattered by the North's ungentle blast;
 While one Great Supreme is only cherish'd,
 And the pageant host of Heaven o'erpast,
 Sadly now I scan the starry cave—
 There no more art thou, Selene, found!
 Through the woods I call, and through the wave,
 They give back an empty sound.

All unconscious of the joys she renders,
 Of the spirit that rules her, unaware;
 Heedless of her own surpassing splendours,
 Senseless to the bliss she bids me share;
 E'en unmindful of her Maker's praise—
 Like the dead beat of the swinging hour,
 Nature, of her gods bereft, obeys
 Slave-like, mere mechanic power.

To renew at morn her course diurnal,
 Every night she digs her grave profound,
 Whilst encircling moons, in flight eternal,
 Wheel their one unvarying axle round.
 To their home—the realm of song—retiring,
 Have the gods on flagging pinions flown,
 Useless to a world no more requiring
 Other guidance than its own.

Yes! they've home returned, and with them vanish'd
 All the beautiful and all the great:
 All sweet hues and tones of life are banish'd,
 And a soulless world usurps their seat.
 Rescued from the flood of time, they hover
 Freely o'er the tops of Pindus high.—
 What shall live in song when life is over,
 First in mortal life must die.*

I repeat that the whole poem is to me but the representation of a poet's tone of thought. The author of the Remarks also does not appear to wish to lay much stress upon it, with the exception of that part where there is an argument for the unpoetical in astronomy, but I cannot grant this exception. There might, perhaps, be grounds to treat the case in such a manner as if it were of more importance, not for the intelligent author of these Remarks, or for other intelligent men, but for the sake of those who have neglected to

* Translation of Schiller's Minor Poems, by J. H. Merivale, 1844.

acquire a thinking comprehension of the world in connection with the cultivation of their poetical faculties. I shall soon return to this case, but I will first take notice of one passage which permits me to point out an agreement, exactly where the Remarks would suppose the contrary. It is said in the Remarks, page 314,—

“The author has by this work increased the merit which he previously had acquired by his theory of the Beautiful. But however justly and ingeniously he has proved, that the pleasure which we feel in the presence of beautiful forms and sounds, proceeds from a hidden Reason, which appeals to us from them, still, this scarcely explains the whole impression. The connection of Reason, ‘the co-operation of a variety of natural laws under one governing unity’ (see above, p. 36), may be a *conditio sine quâ non*, without which an object cannot give us the pleasure which always accompanies the Beautiful; but the deeper impression which the Great Artist places in His work, and by which it appeals to, and stirs our whole nature, can scarcely be explained from this alone. Not merely the harmony of the artistic work gives us pleasure as rational beings, but the imagination of the Artist influences us, and leads the soul beyond the narrow limits of the Present; and the feelings with which the breast of the Artist was penetrated when He created his work, rouses corresponding feelings in us.”

In the praise which has been here conferred upon me, I acknowledge with pleasure the agreement that subsists between my respected friend and myself; and I am glad to be able to show that this is even greater than he thought. This may be seen from the following passage from my Dialogue on the Fundamental Principles of Beauty, published among the papers of the Scandinavian Literary Society for 1808, (see page 347, of this volume). Though the question in that paper is only of the creative part of music, yet, as a whole, it shows that my opinion of the activity of the mind during the production of actual poetical works is not opposed to it. (See p. 347, from “Do you not think it probable,” to p. 348, “requiring such a calculation.”)

It is now easy to perceive, that what I understand as the activity of the poet's mind, comprises the most entire acknowledgment of his freedom. The dissimilarity which is discovered in our comprehension of the relation between human and divine freedom lies higher, and belongs to a circle of thoughts in which the profoundest thinkers, Christians as well as those that are not Christians, have always followed

dissimilar paths. All the friends of truth will gratefully welcome the mind which can throw some light upon this point.

It will no doubt be useful, if in a few words I can comprize the results of the preceding observations. Contrary to the conjectures of the author of the Remarks, I agree with him in the following points. The poet, with perfect justice, creates a supernatural world for himself, in which the imagination, and not the understanding, has the mastery. The entire freedom with which the imagination acts in the poetic world, must not, however, be wild and unbridled, but rather should offer a complete world of beauty, whose laws must not be transgressed. All nature, as it is pictured to our senses, is at the poet's command, notwithstanding that science, in many cases, shows that that which to the comprehension of our senses seems to exist, is actually entirely different. I still hope that he will concur with me in the limits I here place, namely, that poetry should not set herself in intentional and manifest contradiction with that reality which knowledge points out, and that thus it must not introduce the supernatural alternately with the natural, so that the mutual contradiction of both should appear in strong colours before the imagination.

That it would hardly be possible for us always to agree in the application of individual cases need not be considered here, as this is so frequently the case in the application of truths.

I leave to the author of the Remarks, and to those who agree with him, whether the limitations which I have offered must not be accepted; namely, whether opinions which have appealed to the imagination of man during centuries, but which yet come into collision with an imagination which has arrived at a distinct view of a different reality, ought not to be avoided in poetical works of the present period, unless they take us back to a former age, or remain in a purely supernatural world.

Finally, I think I have sufficiently shown, that I do not deny the free activity of the mind during the production of beautiful works, but that I rather acknowledge it as a consequence of my mode of comprehension. I may now pass on to the assertions on poetry, in which I cannot agree with

the author of the Remarks. I have said, (p. 73,) "Since the greatness of science," &c., to "poetical world."

I afterwards gave numerous examples in confirmation of this, which, however, I must pass over now, but for which I refer to my former paper. (See pages 73 to 76.) I must the more particularly beg the reader will turn his attention to it, as the argument in the Remarks might easily lead the thoughts away from what seems to me the most essential part of the matter. After I had introduced some explanatory examples in the above-mentioned passage, I found it necessary to say, "it is natural," &c, to "love its admirers." (See page 75).

The Remarks are almost exclusively turned to the question of the applicability of astronomy to poetry. In page 294 it is said :—

"If the Laws of Reason, which through Science we have learnt to recognise in the order and movements of the Solar System, were suitable matter for poetic treatment, why has it not been so employed, as indeed many poets have by no means been deficient in the attainments necessary for that object. One great poet has certainly viewed Nature in conformity with 'modern knowledge,' and what he saw he has expressed in the well-known lines—

'All those blossoms, late so fair, have perished,' &c."

(See p. 149.)

While I reserve for a later occasion what I may have to say on Schiller's authority, I pause at the thing itself. I am misunderstood if I am supposed to be of opinion that the laws of the order and movements of the solar system, ought to be the subject of a poem; whereas this beautiful order may be well exhibited in short poetical strokes of imagination, and this, as it seems to me, has not unfrequently happened. If I also incline to the opinion, that the laws which have been discovered in the system of the world are not in themselves suitable for a comprehensive poetical representation; still this opinion is by no means in contradiction with the thought, that a clear view into the arrangement of the system of the world might furnish a motive to a great poetical mind for the most glorious poetic themes.

But why has such a work never appeared? I cannot indeed answer this with certainty; but this I can say, that I am not aware that any celebrated poet has possessed the

distinct information necessary for it. If we must consider the poetical condemnation of astronomy before-mentioned as seriously intended, I should be obliged to say that Schiller clearly showed that he mistook the skeleton for the whole body. How much astronomical knowledge he possessed I will leave undetermined, but every one will perceive, if but reminded of it, that during the composition of his poetry all that he possibly might have known of the organic beauty of the solar system, and of the probability, almost bordering on certainty, of the existence of rational beings on other planets, lay far removed from his consciousness. Above all, we may remark in the argument here contended for, that the deep reason which science during her progress has always more and more discovered in Nature, has been only latterly comprehended in such a connected manner that it appears to us as a whole; and not merely in an ideal sense, but as a whole which is intimately bound up with the manifest operations of Nature. In short, the Spiritual in nature has never been so revealed by experimental natural science as in our own century. I must mention the author of "**Heinrich von Ofterdingen*," as a glorious example of the powers to seize and to represent this spirit. One of his miner's songs admirably exhibits the loving and confidential intimacy with nature, in the higher-educated miner; another depicts in a more strange manner, but yet with thought and truth, the relation of man to the hidden powers and treasures of the mountain, and in many passages where the stanza does not indicate the poetical comprehension, this romance gives us glorious poetical representations of the internal history of the globe. His song to wine, gives us a beautiful poetical picture of the process of fermentation. In this way he far anticipated the comprehensive spirit of his period. Goethe, who joined to his great poetic spirit a true insight into many branches of science, with a mind fitted for a thinking comprehension of Nature, has represented in his poem "*The Metamorphoses of Plants*," the spirit of the doctrine which as naturalist of the world he had proposed on the same subject; his poem on Howard's comprehension of the forms of clouds deserves also to be mentioned. In many other passages of his writings we meet with poetical

* Friedrich von Hardenberg, better known by his literary name Novalis.

• comprehensions of those conditions in Nature, which he had regarded in a scientific light, and which only needed the form of verse to be recognized by all, to be what they really are. Had it not been that that great poet entirely misunderstood mathematical physics, perhaps misled by the one-sided manner of representation of certain philosophers, he would probably have done much more for the poetical representation of the views of Nature. But I should say far too little of Goethe, as a poet who was enlightened and guided by a thinking comprehension of Nature, if I merely noticed the poems in which his science appears most forcibly. What other German poet has shown himself such a thorough observer of Nature? Even in his delineations of men we see that he gave a character to the being created by his own poetical imagination, which the profound observer could alone have given. This great man, with his comprehensive science and knowledge of the world, was in truth a poet of Nature, taking the word in the full extent in which I used it in my condemned book; he therefore has made far less use of the poetic garb of past days than most other poets, but furnished himself with means direct from Nature herself. It is easy to perceive that I understand by the poetic dress of past days the tenor of the "poetic inventions" which past times have left behind. I do not attempt to deny that it has been often used by the great poets with true and masterly skill; but I think that poets would exercise a far higher influence if they did not so frequently take refuge in it. Goethe was perfectly conscious of his nature-loving poetic imagination and of his poetic love of nature, and expressed this, among other passages, in the following epigram—

Is botany—are optics thy vocation? What doest thou?
Is it not greater gain to move one tender heart?
Ah, tender hearts! a fool can on them play.
Be mine the joy alone to touch thy chords, O Nature!

I certainly trace the expression of a poetic whim in the distinct one-sidedness of this declaration, but take that away, and it reminds us of his true love of an insight into Nature, of which besides his writings in themselves bear the most evident proofs. I do not venture to bring forward more examples lest I should choose such whose value might be less acknowledged; but at all events I must repeat what I have

already said, that it is only from the future that we must expect the comprehensive and poetical application of an insight into Nature.

I now again return to the poem of Schiller so frequently mentioned, and venture to bring forward one passage from my earlier writings in which I have attempted, in a poetical form, to counteract the impression of this poem, and many poetical attacks on our century and its science, which have been produced by misapprehension.

To understand it properly I must mention that the following is a fragment from my poem "The Balloon," in which I attempt to depict the spirit of discovery, in one poetically comprehended event, or in a series of events. The scene of the conversation lies in Samos, where there is a promontory which points to Icaria, and reminds us of the unfortunate attempt of Icarus to fly, well known from the legends of poets.

The Characters are:—

ERNEST, *a German Antiquarian.*

FRANKMAN, *a German Naturalist.*

CALCHAS, *an Athenian, who has been educated in Germany.*

Then gladly Ernest spoke, for he was vexed
At former interruption of his words:
"A nation's worth is not by lavish wealth,
Nor e'en by power, or numbers, to be measured;
The well-skilled labour of the swarming bees
Wins not the prize; theirs not the noblest end;
Ripeness alone, and energy of life
Can be the measure of a nation's worth.
And how displayed to him who takes delight
In greatness? Solely, in the arts divine,
And self-ennobling efforts—all may see
The glory of great Hellas; she who stands
Upon the pinnacle of art, and verse
Inspiring to high deeds. Where lives the sage
Who would not to the Past award the palm?
Then had man reached in fresh and youthful prime
Life's highest summit. Art, and chivalry,
And tales of love sung in a later age,
Their shadows; for th' impoverished Present
Nought then remains, but strife and learned lore
And the sad story of State Policies.
Eden has passed from earth and left us here
A weary hermitage of misery."

Then Frankman rose and met their looks expectant.
 "Well hast thou said, if nations should be judged
 By energy of life in them displayed ;
 If, then, thou seekst the stamp of life alone
 In beauty, or adornments, such as add
 A charm to make life brighter, surely thou
 Hast, with a dazzled eyesight, life beheld :
 For he alone can form a judgment true
 Who does not fix his eye upon one object
 Of shining splendour, but with vision large
 Embraces the great whole, while carefully
 Each sep'rate part he views.—Upon thy lips
 Already I perceive the impatient word ;
 Beauty, thou wilt assert, does of itself
 Comprise a whole ; but Science, Virtue, Faith—
 Each, I maintain, are as complete as Beauty.
 If, to our mortal sense, it were allowed
 Truth to behold, entire, and undisguised,
 We then should live in Beauty, and our faith
 To perfect vision changed, our virtue be
 Divine ; Faith perfected, would Knowledge hold,
 And Art, and Virtue, and all heavenly things
 In her embrace. But here, all that is great
 Is but as piece-work, which to comprehend,
 The parts must first be known. If justly, then,
 The merits of all ages thou would'st try,
 Let thy far-searching eye wander around
 The wide domain where life its power declares ;
 Never before was there a time so rife
 With thought, that moves in all life's varied scenes,
 Piercing each channel of man's social being,
 As this, which thou with so much scorn hast named
 'Th'impoverished Present.' From sublimest search
 Into the source of Thought, or after suns
 Whose light illumines worlds beyond our ken,
 Or into laws which here in silence rule
 Great Nature's mysteries concealed from man,
 Down to the labourer, who his daily bread
 Earns by hard toil and sweat upon his brow,
 The Spirit of Invention lives and moves ;
 Thought, ever active, works in each and all.
 I will not pause to speak of deeds of fame,
 Of glory won by warrior and by prince,
 Since such alike have ev'ry age adorned ;
 But turn to Love, that spirit which unites
 Man to his brother ; slav'ry hating,
 Not for himself alone, but all mankind.
 My friends ! it is, then, Love which doth exalt
 The Present, and ennobles it above

All that the admirers of the Past can praise."
"The Present speaks in thee," Ernest replied,
The Past in me. Enough." Then Calchas rose
By fiery youth impelled; with glowing cheek
He combated the stranger's cautious words.
"Think not thy soul can fully comprehend
The Beautiful which lived in ages Past;
Thou, who canst not perceive, far less admire,
The Beautiful and Great of later times.
Wilt thou the world with other eyes behold—
Eyes of the Past? Then summon to thine aid
The Spirits of the Past, and let them here,
With vision clear and open, look upon
The labours of the Present. Thales call,
He, whose inquiring mind paused musingly
On the mysterious power, to action roused
By amber rubbed. This power (to him) a spirit
Woke from its slumbers by all-wondrous art.
See how that spirit by our nurture grows!
Let him behold it now as lightning gleam;
Teach him to look, led by the clearer light
Of deep investigation, how the power,
Which in the flashing lightning blinds the sight,
Or in the rolling thunder deafening peals,
Doth silent dwell in all material things
Be it in water, or in air, or earth,
Or in the gifted ore; as the spark lives
In stone, by art from darkest night drawn thence,
And to the senses wonderful revealed .
In all its varying forms; tasted in salt,
In heat and light perceived; now in the flame
It writhes, and in the faithful magnet now
Points a sure pathway to the mariner;
It lives in branch and leaf, in muscle strong,
And shrinking nerve; the eye material
Cannot detect it, yet is it revealed
To the soul luminous. Let him behold—
Then do thou well reflect how such a sight
Will move him. Call Pythagoras and bid
The sage to mark the laws divine which rule
Each planet's course; and when he reads and sees
Such harmony amidst the countless worlds,
Trembling with joy his heart will overflow
Before the sacred concert of high reason.
What Mathematics have for us achieved
Let Euclid see; and how on Nature's steps
They follow close, their constant progress marked
Neither by sudden pause or forward bound
But leading on to infinite results

Of computation which he dreamt not of.
 Then Aristotle, once the king of men,
 Great prophet of the heathen! through the lapse
 Of ages past, Christian, and Islamite,
 Thee as their master owned, and unto thee
 The learn'd do homage still; who first to man
 Reveal'd the depths of thought, and did unfold
 The secret laws which guide the heav'n-taught poet
 In his creations; and with equal skill
 And clearness did the policy declare
 And laws by which a kingdom may be ruled.
 Great Spirit! thou with fearless eye surveyed
 All nature, still by thy light we read
 Wisdom in ev'ry living creature's form.
 Consider us aright, and thou wilt find
 No pause in our deep earnest search for Truth;
 And thy free spirit a charm will ever hear
 In verse romantic, produce of our age.
 But what the Present time has best conceived
 For the State's good, and for the gen'ral weal,
 (However from perfection far removed,)
 Thou wilt assuredly confess to be
 A progress great and glorious, although
 Such knowledge may appear of little worth,
 Compared with all philosophy has gained
 Of Nature's works." Here Ernest spoke in haste,
 Nor could contain his words impetuous.
 "Thy eloquence is always moved to speak
 In praise of the one knowledge which belongs
 Unto the Present, though of spirit and soul
 Sterile and void." Then Frankman straight replied—
 The man of wise and comprehensive soul:—
 "Hadst thou this question duly weighed, then ne'er
 So crude a judgment couldst thou have pronounced.
 He who has found the end of his research,
 A soul oppressed with knowledge there to end,
 Has only read the book, not grasped the sense.
 If ancient Greece had nature's secrets known
 As we, then would not her famed poetry,
 Or proud philosophy have now become
 Degenerate; for scarcely *thou* wilt doubt,
 That to harp ever on one fav'rite theme,
 Will by degrees lead us away from truth.
 Let the eye always contemplate one form—
 How soon 'tis dazzled!—and the image gained,
 Desire increased for more, in eager quest
 Falls into wild extravagance and falsehood;
 And even mayhap the brain in madness reels,
 E'en where the soul is never thus profaned

By such desire ; yet fixed on one idea,
Closing the mental eye to all besides,
Rejecting the vast wealth nature presents,
And gazing as one in a waking dream,
The soul will pass away. Too long within
Our native Germany there have been some,
Who strive with daring wing aloft to soar
Over the barriers safe of certainty,
Which here inclose Art and Philosophy.
Ye fools ! intoxicated with desire
To gain what Nature placed beyond our reach,
Truth ye reject for wisdom's semblance
And empty phantoms. In Philosophy
And Art no power can check the wayward flight
Of the wild visionary, save the search
Into the depths of Nature's laws profound.
Here, life of action—here the eye beholds
Reality. With rapid strides she comes,
And with new weapons ever armed, subdues
Conceits, and silly fancies which have grown
To be revered through age. In deeds, not words,
Not in the meditations of the brain
Sophistical she rests ; but each day tells
How she by countless works her power retains.
Dost thou not now behold the bulwark fall,
The dreams of him—the visionary, fade ?
Oft has the voice of Wisdom been decried,
When she hath dared some fond conceit to quench,
Which by the multitude has been embraced ;
Opinion then alone can be subdued
When seen by all ; for else Truth's staff of office
Is snapped in twain. How many a prejudice
Has vanished when the lightning's flash is led
By the slight wire obedient to the ground.
Since we have learned the motion of the earth,
What baseless theories have been destroyed !
Since we created visions for ourselves,
How many a wandering sprite has disappeared !"
Ernest replied : " I never have denied
That Intellect has triumphed ; yet, with life
Adorn it as thou wilt, my inmost soul
Still cleaves unto the golden time, when life
Was not a mere reflection of cold reason.
Pardon me, if I still maintain, that Helios,
Guiding his fiery steeds, still rouses in me
A more poetic ardour, than the sage
Who tells me of a lifeless circling ball,
Blind to its own effulgence, and which spreads

Rich blessings o'er the land, yet feels no power
Or pleasantness ; rejoices not to hear
The voice of praise, nor can itself return
Thanks to the Giver. Darkly it moves
As the mechanic's wheel ; the heavens are empty,
And the wide space, once dwelling of the gods,
Now tenantless, serves but the slavish law
Of Gravity. Away with learned lore !
Leave me in peace, free to enjoy and live
Within the golden dreams of days long past ;
When Orcads filled the heights, and Dryads dwelt
Amidst the groves, and water from the spring
Rippled from vases held by lovely Naiads.
Leave me the Poet's song, e'en as himself
Immortal ! " With generous ardour then
Calchas replied : " Where is the man so rude
Who has not followed in the poet's train
Into a world, his own imagining,
Adorned by him with wisdom and with beauty ?
And shall we, then, despise the inspirations
Of that exalted nation which upheld
The torch to Europe ? Think not such there be.
Yet the poetic splendour of the Greek
Shall not our eyes delude. Is there no power
In Truth, beauty divine, which thou in scorn
Rejectedst ? When in mockery thou sayest,
' Our sphere by Gravity is ruled,' thou hast
The great first cause of Nature overlooked ;
The wondrous force which binds all things to earth
Alone thou saw'st. This force is but a witness
Of the great principle, which in itself
All doth unite. The origin of power
Connecting, ever present in us all,
The pious soul points to th' Eternal Ruler,
He whose Omniscient Wisdom ordereth all.
The watch—an image of the vast machine
Which moves a world. Thought is the origin
Of each ; but with this difference—the first,
The work of man ; his brain inventive, learns
To apply the powers his Maker lent, for good ;
While in the last, a work divine we see,
Gifted with ever-germinating life.
Truly, within the world each separate part
Obedient, without self-volition acts ;
As in the body, not a limb can move
Unless directed by the sovereign will ;
The mind within gives life unto the whole.
Dost thou perceive nought but machinery

In laws which guide the course along heaven's paths?
Look with a larger view around ; behold
The unity of living thoughts, displayed
In countless varying forms. The mighty sun
Is but a twinkling star amidst the space
Infinite filled with worlds, whose suns, heaven's lamps,
Shine in our night. The sphere which bears us on,
A planet only. They the light of worlds,
Whose forms gigantic, to our human sight
In the blue vault of heaven as lesser lights
Appear ; as on its axle turns our earth,
Each planet turns—each in the space assigned,
Till to the eye of him who dwells on earth
The arch of heaven itself appears to move ;
Alternate day with night, motion with rest,
Each planet moves with path unvarying ;
And each rejoices in the changing year
And season, as the sun is near or far.
Again,—call on the souls of men long dead,
And through the telescope let them behold
Valleys and mountains on the pale moon's face,
Moons circling other planets far removed.
Let the astonished gazers turn and look
Upon the spangled heav'ns, there to discover
Thousands of blazing suns, encircled by
Companions numerous ; then, if amidst
This region infinite, the spirits there
Should, prophet-like, a race of beings behold,
Struggling for mental power, knowledge divine,
Would they with longing eyes seek for the steeds
Which draw Apollo's car, or wish to see
Diana, with her hunting-spear and nymphs?
Oh ! they would gladly in that hour renounce
Dryads, and Nymphs, fair guardians of the stream
Could they, like us, behold the hidden course
Of Nature, which provides the flowing spring,
Bedews the grass, where we may almost hear
The breathing of the silent, scented flower ;
And where the sage may trace the active course
Of things with life replete ; the rushing wind
Plays well his needful part. Turn, then, and look
Upon the varied business of man's being,
Where the inventive spirit finds fit work
For the free hands to do. In sooth, we might
A thousand wonders add unto the seven
Which the past world astonished. Now no more,
Since wonders are so rife, that one alone
Seems but the little vessel which hath borne
Us through the misty way. What Nature lent

Her feathered children of the air, to soar
 With outspread wing, free in heaven's azure vault,
 Art has outdone; and now majestic floats
 The dweller of the earth in regions where
 The kingly eagle has not dared to soar.
 Did not the hapless fate of Icarus
 The poet warn, that such an airy flight
 Secure he cannot dare. Praised be the age
 When wonders are so rife, that one-like this
 Is lost among their number manifold."

I hope I shall be excused for having introduced this long quotation, as it may serve to place the scientific and æsthetic mode of thought, which it seems to me must proceed from the proper cultivation and nurture of natural science, in a clear point of view. It is easy to perceive that it is not intended now to reject either that which in ancient or modern times has been considered beautiful; but to acknowledge the co-operation of the discoveries of natural science in the formation of the more extensive kingdom of beauty which is demanded by our own period. I have spoken, not only here, but in earlier writings, of the extension and the union which is thus produced between the comprehension of science and beauty. The tendency of my thoughts has generally led me to illustrate the case from the universal laws of nature, and thence to point to that which is exhibited to the sensational apprehension. There will soon be an inclination to admit the reciprocal influence which must exist between science which has originated from a description of nature on the one side, and poetry and the plastic arts on the other; but it has not yet excited the attention which it deserves. Humboldt has represented this in a masterly style in his *Cosmos*, vol. ii. p. 370—465.* I must refer you to this, and will only mention the principal idea in as few words as possible. The more perfect knowledge of the works and active laws of nature which our period possesses above every other preceding it, and the ocular knowledge of distant countries which is now gained by so many well educated travellers, must give occasion to representations in which scientific accuracy is immediately comprehensible to the imagination. This union is not accomplished by the addition of extraneous

* See Translation from the German, by E. C. Otté, (Bohn's Scientific Library.)

ornaments, which would be in opposition to all true art; but in such a manner, that the nature of the locality may be comprehended in its many and various relations; which necessarily requires a combination of almost all the powers of the soul. The representation of the knowledge thus gained must in that case harmonize with it.

“Without leaving the land of our birth, we not only learn to know how the earth's surface is fashioned in the remotest zones, and by what animal and vegetable forms it is occupied, but we may even hope to have delineations presented to us which shall vividly reflect, in some degree at least, the impressions conveyed by the aspect of external nature to the inhabitants of those distant regions. To satisfy this demand—to comply with a requirement that may be termed a species of intellectual enjoyment wholly unknown to antiquity, is an object for which modern times are striving; and it is an object which will be crowned with success, since it is the common work of all civilized nations, and because the greater perfection of the means of communication by sea and land, renders the whole earth more accessible, and facilitates the comparison of the most widely separated parts.”—(See Translation of Humboldt's *Cosmos*, vol. ii. p. 436.)

The poet, when he wishes to place the scene of his events in a distant land, will also be enabled by the vivid comprehension of all conditions of existence offered to him by science, to give that clear, visible truth to his description, which so much contributes to charm his readers and his auditors. It is the wish of Humboldt that landscape-painting should be much extended by the numerous and remarkable varieties which are afforded by the vegetable kingdom of different countries. He wishes that the landscape-painter, after having prepared himself with an appropriate knowledge of natural science, should reside a considerable time at the different localities, and then produce his works, with that freedom of art which is suggested by the mind which has been thus enriched.

THE RELATION OF
NATURAL SCIENCE
TO VARIOUS
IMPORTANT RELIGIOUS SUBJECTS.

1.—*The Invariability of the Laws of Nature.*

WITH a full persuasion of the ancient doctrine of the invariability of the laws of Nature, I have endeavoured to show in the former part of this work, how, in my opinion, this incontrovertible truth by no means leads to a denial of religion and morality, which many have been led to believe, by a false comprehension of what is required by Nature; but that well grounded Natural Science shews that these laws are dictates of reason, originating from divine reason itself, and this doctrine, if properly understood, is in the most perfect harmony with true morality and religion. The highly esteemed author of the Remarks is not convinced by my representations, but disputes the invariability of natural laws. The principal objection is put in the following words : (p. 299.)

“ No one doubts that the laws of reason, if we may use a theological expression—those *ad intra*, namely, the laws which constitute the nature of reason, are eternal, for reason cannot deny itself. At the same time a law may be quite rational, and yet only be valid for one particular period, whilst the actions, as the author says, must be different, if we act in different circumstances, according to the same principles. The animal and vegetable kingdom of past ages was created according to natural laws, but this has now passed away, and is replaced by other animals and plants, also created by natural laws, which therefore cannot be the same as those which nature obeyed in those former ages. Some people will say—only differently modified, according to times and circumstances; for those laws, being variable, were not fundamental laws. We must indeed at length reach invariable laws,—the fundamental laws of the whole of existence; but the question is: how high shall we mount in order to find laws which are independent of time and circumstances, and which cannot be changed? Nay, why may we not indeed question whether the nature of this whole world, however long its duration may be, is yet, if I may so speak, a temporary arrangement, which can, and will be changed, whilst the reason, which is revealed in it, remains the same?”

It is undeniably true, that, "*the actions must be different, if we act in different circumstances according to the same principles;*" but *if the principle remains the same, then it has not certainly been changed!*" The actions are certainly not the principle, but events, which obey the laws.

The subject, however, is far too important to allow it to be decided in any way which gives it the slightest appearance of a dispute about words. So far as I understand the author, he wished to say, that the altered circumstances were not produced by invariable laws; and we must thence infer, that the gradually developed effects were not necessary consequences of fundamental laws. But this opinion does not agree with what nature teaches us; our researches there shew us, that altered circumstances are in themselves the consequences of natural laws. In the Remarks an example was selected of the altered circumstances by which animals and plants which have arisen at different periods of the earth were differently formed. Since the reader, in order clearly to comprehend the explanation of this example, must behold several examples vividly before him, in which it is evident how closely natural laws are united with one another, and what an immense variety of unusual phenomena may arise from this cause, so that effects which occur under different natural laws mutually influence one another, I will introduce the subject with a suitable illustration.

It is a law of nature that all bodies and parts of bodies mutually attract each other; and it is as certain, that the attraction between two points is inversely the same as the squares of the distances. The force with which two points attract one another, is therefore a hundred times less at a distance of ten feet, than at a distance of one foot. The distance may undergo innumerable changes, the law remains the same. But from this law it further follows, that all bodies fall perpendicularly towards the surface of the earth, namely towards *that* surface which the earth would have, if all its inequalities were away, a surface such as every expanse of water exhibits. If it is now proved, that a body falling very near a large mountain deviates slightly from the perpendicular, does this shew that the law is changed? or does it not rather shew, that in consequence of the law, the deviation takes place from the attraction of the mountain? We further find that a body does not fall everywhere on the surface of the

earth with equal velocity, although it is the same mass of earth which attracts; but does this shew a change in the law of Nature? No; it is because another fixed natural law interferes with it; namely, the law of centrifugal force, which, itself a necessity of reason, is only a part of the combined laws of motion. By this law, it has been calculated that the velocity in falling, increases, the nearer we approach the poles; and we should not forget that this inequality had been calculated long before it was discovered by experience. I say an inequality, because its foundation rests upon a unity, namely on a unity of law, and by the necessity of reason is formed out of generally prevailing laws. The law of attraction is recognisable under a variety of forms, in many other natural events. If we set a body in motion, attraction acts upon it every moment as much as if we had not given it this motion; but from the union of these two influences, there arises a new velocity and direction from the laws of the motion imparted, and from the subsequent fall. Thus an obliquely ascending motion imparted to a body, causes it to describe a parabolical figure. At the same time, in this example, I have for some minutes paid no regard to different co-operating circumstances, and especially to the resistance of the air. This produces a change in the form of the path described, but exactly such a change as the natural law of resistance requires.

Even when currents of air change the path of the projected body, this does not happen because the *laws* of attraction, of motion, and of the resistance of the air, are altered, but because an effect is added, which is regulated according to the laws of the currents of air. Bearing in mind the same laws, if we now imagine a body which has received motion far above the earth, beyond the region of our atmosphere. we can, from the same principles, mathematically prove that it must describe an ellipse, whose size and deviation from the figure of a circle is determined by its velocity and distance from the earth. In this manner we can calculate the ellipse described by a body, which is as distant from us as the moon, and behold, it is the same path which the moon actually describes! A few centuries ago, the inequalities which were discovered in the path of the moon appeared so inconceivable that they were compared to freaks. The laws of attraction, discovered by Newton, gave him the means,

even at that time, to account for many of these inequalities, and to find there existed still more inequalities which observation had not then discovered, but which were afterwards confirmed; and now, by means of the higher cultivation of mathematics, it is possible to calculate beforehand all these inequalities, and to such a degree that calculation satisfies a far more delicate power of observation than we formerly possessed.

But our thoughts cannot stop here. The moons of the other planets, and the earth, with all the planets round the sun, move according to the same laws. I will not explain this more minutely, but will only remark that we find in all this variety innumerable inequalities in distances, directions, velocities, &c., which all follow the same laws. Science, by her predictions, defies the arguments which ignorance has occasionally produced; these predictions are not few, obscure, undetermined, or only accidentally coincident, but numerous, clear, determined in point of time and place, and never-failing. We here see a great example, and yet, when compared with the richness of its contents, but slightly developed, which may explain to us the important truth, that the consideration of Nature offers to us a connected view of the ever-present manifestation of divine reason in the Finite. We do not here speak of signs and presentiments, but of mental demonstration.

After this great example I shall be able to treat those which follow more briefly, and to employ them principally as an illustration in various ways of the character of the laws of nature.

We learn from chemistry that the natural action by which iron is rusted is combustion. But it is a law of Nature that combustion produces heat; do we not here meet with an exception? It only appears so; for this combustion takes place so slowly that the heat which is every minute evolved is too little to be proved by our instruments of measurement. The answer is perfectly satisfactory, but it can receive another support, if I may so express myself, from without. By means of chemical experiments, by which it was attempted to restore some iron-rust to its metallic condition, the metal was changed into the form of powder. When the innumerable small surfaces of the iron-dust come in contact with the air, they become rust, with a rapidity a thousand times

greater than that which took place in the solid mass of iron; and, in this instance, a powerful evolution of heat is not wanting.

It is a well-known law that fire produces heat; but if we put water into a red-hot crucible which contains liquid sulphuric acid, it will be changed into ice. To those who are not versed in science, this appears an extraordinary exception to the law. But the scientific man may note it down as a triumph. He knows that actions here take place which obey different laws. The one is the communication of heat, by which water receives a higher degree of heat; the second is evaporation, which produces cold. Liquid sulphuric acid evaporates with a greater rapidity than most bodies, and produces such intense cold that the water not only loses all the heat which it receives out of the hot crucible, but a great deal more, and thence arises the effect, so astonishing to the imagination, that water becomes ice in the midst of fire. Those who are acquainted with the fact will see that I do not here enter into all the minute circumstances; but they will also know that they are not of that description that from them an exception can be made, in the constancy of natural laws.

Such a union of several powers, where each acts according to its own law, is so far from being of rare occurrence, that it is rather the usual mode of action in Nature; thence an infinite variety of effect is produced; but with all this variety in time and space, it is only the effects which suffer a change, the laws which they obey remain the same.

Bearing this in mind, we must look at the more complicated actions in nature, for example, the life of plants. The plant feeds itself upon certain materials, whose circulation and chemical combination is promoted by heat and light. The laws by which heat and light operate in the plant are inevitable, but the effects springing from them are various.

Heat produces many changes in the chemical reciprocal action of matter, and this is also naturally the case with the chemical action which takes place in the vegetable kingdom. These effects, as well as evaporation, are caused by heat, in accordance with determined natural laws, which are the same in the vegetable kingdom as in all the rest of nature.

In the dry, hot seasons of the torrid zone, the evaporation produced by heat, both in the ground and in plants,

has such a preponderating tendency to dry up, that the water which dissolves at last loses the chemical action by which the nourishing materials are carried through the different parts of vegetables. Now, if the chemical action in these plants ceases for a period, it is not caused by the cessation of those chemical laws—these remain unaltered—but because one of the conditions of the chemical effects consequent to the natural laws of heat has been arrested. If another season brings with it the necessary moisture, the mutual action of the dissolved materials again begins: it need hardly be said that the seasons themselves originate in natural laws,

It would occupy too much time if I were here to treat of the laws by which light affects plants, by which the carbonic acid of the air is imbibed by the leaves, and again by which these fill the atmosphere with oxygen, and many other laws which are of importance in the active forces which influence the lives of plants. I think I have said enough to show that it is not the laws of action which undergo a change, but the actions themselves, in proportion as they coincide with the course of the laws which govern the whole.

I found it necessary to make this preliminary notice before I could venture to pass to the example introduced in the Remarks, for this is borrowed from a branch of science which is not nearly so well understood as the doctrine of motion or astronomy, or as the observations upon the life of plants on the surface of the earth; it might therefore be possible, that any one who thought it worth while to take a part in the present discussion, might make use of the points of dispute offering themselves here, and thus perplex the whole matter. We must next show, how it was possible that the numerous changes which took place during the development of the earth, usually happened under the same laws. A glance at the present theory of the development of the earth which is now generally adopted, will suffice. I consider it essentially correct; but if we had not such indisputable proofs from so many other sides, of the invariability of natural laws, an example borrowed from a less developed branch of science might be easily mystified, not to the true natural philosopher, but to many who justly desire to participate in the explanations which may be here given. It will now be evident, that it would not destroy the intention, of the following statement, if it were contended that the planets were in

a state of vapour before they became liquid; but it is still easier to prove that they were liquid before they became solid. If we were to give up the idea that the vaporous condition first existed, we certainly could not account for the greater degree of heat at an earlier period; but that it did exist, and that it gradually cooled in the course of time, would still remain certain by other proofs. Even if other influences occasionally produced some interruption in the gradual cooling, our explanation in the present example would equally serve as an illustration, and from our certain knowledge of the invariability of natural laws, it would not fail in its power of conviction. The earth was developed by laws which have never changed, but its condition has undergone incessant change. In the many thousands—indeed, perhaps, millions of years, which preceded the formation of the first organic bodies on the earth, it was converted by a series of condensations from an enormous ball of vapour to one much smaller, not very unlike the size of our present earth. According to a well-known natural law, these condensations emitted a great deal of heat, far surpassing what was at the same time lost by radiation. When the contraction had fulfilled the principal part of its work, and the earth was brought nearly to its present density, it was in a very heated condition. The condensing action was no longer sufficient to produce as much heat as was radiated; its surface became liquid; a great part of the vapour surrounding it was condensed; it now became an inwardly liquid ball, surrounded by a firm crust, covered with such a hot sea, that neither plants or animals could exist on it. But the process of cooling always continued; and when the surface was reduced to a temperature which probably little exceeded what now exists in the torrid zones, plants and animals began to develop themselves. We learn, from the oldest strata in which these remains are found, that it was only the least developed organic forms which then existed. The atmosphere at that period was of a very different quality from what it afterwards became: it abounded in carbonic acid, and was deficient in the air necessary for respiration, whose principal element was chemically united with the carbonic acid. On account of the intense heat, the atmosphere contained a great quantity of vapour; in the upper regions of the air this vapour was condensed by giving out heat to the heavens, and therefore far

denser clouds must have been formed than now exist, and thus less sunlight could penetrate them. But in consequence of the invariable laws of heat, the cooling process continued; a great part of the vapour was thus condensed, the atmosphere became clearer, which enabled the sunlight to act more powerfully upon the earth, and by that means to produce unequal effects on the different parts of its surface. During the various changes of condition which arose in consequence of what we have here described, more organic forms were continually developed; sunlight, so favourable to the life of plants, increased; the large proportion of carbonic acid in the atmosphere gradually gave more and more of its carbon towards the nourishment of plants, whence its oxygen became separated as vital air, and the atmosphere became better adapted to the life of animals. It thence follows, that each natural period must have prepared for the succeeding one. We find in the remains preserved in the earth a series of forms more and more developed, which succeed one another, till at length that condition was prepared, in which man, and the animal and vegetable world adapted to the wants of man, could prosper. It is probable that this began when the proportion of heat was such that the globe did not annually radiate more heat to the heavens than was restored by the sun, or that this equilibrium was so nearly attained, that our observations could not discover any perceptible change; and, so far as our knowledge of the productions of the vegetable kingdom in different countries is communicated to us through history, we are fully convinced that this was the case.

I do not feel myself called upon to investigate here the ideas which are exhibited and further developed in that part of the Remarks which we have considered (p. 198, &c.) concerning the present world being a temporary arrangement, and the future world of a completely different nature. I shall be satisfied if people will believe with me, as a certainty, that the world in which the human race was created, and has been developed, in which it has received so many revelations of the all-penetrating, all-ruling Divine Reason, and in which reason rouses so many presentiments of the numerous habitations which are promised us in the house of our Father—that that world, I say, is governed by an eternal Reason, whose mode of operation is recognized by us as the invariable laws of nature.

I am well aware there are many who think that the conception of the world here exhibited, which, though of old date, is still very imperfect, leads to terrible consequences, and threatens to deprive them of many notions in which they formerly found consolation. I do not consider it to be worthy of the subject to prove the existence of that which could remove this fear, without first mentioning that our wishes should not determine what we desire to receive as truth. Should we not feel inwardly ashamed if we caught ourselves in the endeavour to desire a different truth than that which actually exists? And what folly it would be, if we allowed ourselves to be determined in our opinions by our desires. Our wishes and desires could not make it true! No; let us honour truth: it is indissolubly united with virtue. The whole truth brings its own consolation with it. I will endeavour to show this in regard to this very subject. I know very well that this undertaking which has been so often attempted, is one of the most difficult, and perhaps can never be executed to general satisfaction; but still I hope that those who have made themselves familiar with what I have already said upon this subject, (p. 121-127,) will afterwards follow the explanations which I shall here give, and through them see that image of the most perfect harmony in the world of reason, which they brought with them, still farther carried out.

2.—*Can the government of God dispense with his Arbitrary Will?*

The opinions of philosophers have always been very much divided upon this most difficult question. It is a dispute which has not hitherto been decided before the tribunal of mankind, and will probably be often renewed, as it is at present between my most respected friend and myself. We are of course agreed in believing that God governs the world with infinite wisdom; but, on one side, it is asserted that the incalculable encroachments which are made by man's freedom in the progress of things, produces irregularities which cannot be removed by an all-embracing divine legislation, but that they require particular decrees demanded by the events, as is the case in the government of earthly states; on the other hand it is assumed that the divine government of Reason is so perfect that, without any after-aid, it arranges

those events produced by the irrationality of man in the rational plan of the whole. It might therefore appear that the mode of comprehension which I follow attributes greater wisdom to God than the one opposed to it, but it would be very wrong to allow such an appearance to rest upon the opposite mode of comprehension. Those who assert the necessity of the arbitrary dealings of God, attribute to him the greatest *possible* wisdom; but they think that an eternal legislation can only regulate those actions which must of necessity occur, and that it would be an *impossibility* that such a legislation could remedy the abuses of freedom.

While I can with perfect conviction maintain what I said in the division of an earlier paper, entitled "The essential principles of morality the same throughout the Universe," (pp. 122-125), I yet think it advisable now to develope and defend my opinions far more circumstantially.

It is the opinion of some people that the perplexing encroachment of accidental causes in the progress of things cannot be adjusted without the supervision and assistance of an arbitrarily-acting Being; but this is a mistaken idea: if we only know the nature of the disturbing cause, or of the disturbing causes, we can frequently prevent their effect. This is more certain to happen, the greater the understanding and the insight which are thus put into action. If all that we can accomplish as men be ever so little, still it shows us the possibility. To Infinite Reason infinitely more will be possible.

I will illustrate the case by a series of examples, and shall of course begin with those which are easiest of comprehension. Let us transport ourselves back a century and a half ago. It was required that a clock should be carried on a voyage round the earth, and that it should constantly retain its regular course. If we only consider the principle, we must find that this is impossible; from the change of temperature as well as other circumstances, the length of the delicate spring, and of the diameter of the pendulum which regulates the watch are altered; it is therefore declared impossible that it can preserve its regular course: the maker of the clock, or some one sent by him, must accompany it to correct the irregularities. But, no; this is not only unnecessary, but would be quite inadequate for the purpose,

for the artist who understands the laws by which the effects happen, is able to add particular parts which extend by heat in such a way as to remove the error; and now, whether the captain of the vessel may choose to go to a hotter or a colder climate, the course of the clock remains the same. The case is sufficiently familiar in our own times, but we have here regarded a past period when it was unknown; a century and a half has not elapsed since then.

By the use of steam-engines, great powers are put into activity; but a mistake in their management may be dangerous. The engineer may increase or lessen the fire as he pleases, he can even increase it to an unreasonable degree, and by that means give such an expansion to the steam that it would burst the boiler, if a contrivance had not been discovered to prevent it. That, as we all know, is the safety-opening, with the safety-valve of the boiler, which allows the steam to escape when its expansion is too great. In the earliest constructions of the steam-engine, some one was always obliged to be at hand to turn the cock which either opened or closed the opening for the steam. Neglect or oversight must have produced evil consequences; arrangements were afterwards contrived in which the engine did the work itself, and with greater security. The amount of resistance which the steam-engine has to overcome, frequently changes considerably. If the resistance were suddenly to cease, the velocity of the engine would be increased to a dangerous degree, but a plan has been invented which immediately lowers the steam if the rapidity increases, and raises it again if the rapidity lessens.

These examples will perhaps be thought far too insignificant to be mentioned; but at the same time it would not perhaps have been right to despise the light which they throw upon the subject. If it had been prophesied that exactly these counter-effects and these means of prevention would be discovered, most people would have thought it impossible. Such examples may at least serve as a warning to those who confidently wish to prove a thing is impossible, because they cannot understand how it can be accomplished; a totally different design from that which deduces the impossibility of a thing from an actual inward contradiction.

But we will now turn to an example which more nearly

concerns the subject, and which is so great that it embraces within it innumerable smaller ones. Let us transport ourselves back to a time when men were, either everywhere or on a large portion of the earth, in a very savage condition, without laws or a civilized society. Each individual man endeavoured to use his unbridled will against others; there reigned universal civil war, in which murder, robbery, and every kind of oppression met with no more opposition than the resistance which was offered by the sufferer to those who attacked him. Let us now imagine that the following question is put to a man in this condition:—Could we not introduce such a happy condition in which the powerful would allow the weak to retain their own, the exasperated would renounce murder and other violent deeds, and the impassioned man would curb his desires when they injured others? Roused to thought by the question, he would undoubtedly reply:—We can never ourselves produce such a condition: such a happy state of things could only be attained if a God were to come among us, who would protect the weak, and would threaten and severely punish the strong, if they did not obey him. We who know what may be performed by laws, and by regulations for upholding the laws, are only astonished when, looking from them, we cast a glance at the wild forces which they have subjected in such a remarkable degree. Every desire which originates in the human breast to possess, or to enjoy, what is the object of desire of another, challenges a dispute; a dispute arouses more violent passions, and even grows easily into a contest for life and death. What innumerable germs of wicked passions! If it were possible that men could assemble together in numbers in a locality which had not been previously prepared for them by some legislation and civilization, the most frightful crimes would be of daily occurrence. But when we look back at the succession of different conditions, which, as far as it reaches is displayed to us by history in every country in which a higher social condition has been developed, we see how extraordinarily great are the difficulties which legislation has to overcome. However distant we are from being satisfied with even the best social condition hitherto attained, still those who preceded us at a great distance, are to be regarded in comparison as savage and lawless. It would occupy far too much time were I to explain this here; every-

one will be more strongly convinced of it by his own reflections on the social condition which history describes, the more detailed the historical picture which he forms for himself. In return it will not be useless to observe at present, though only in a few examples, the manner in which laws operate.

Man's desire to appropriate to himself whatever pleases him, belongs to the first objects of legislation; it must be restrained by severe punishments directed against the seizure of property belonging to others. The immediate effect is only to deter by terror; but he who would place therein the whole, or even the most powerful effect of the law, is much mistaken. Law countenances man's feeling for the justice of rational claims. He found it was necessary for the common welfare, indeed for common rational intercourse, that every one should be secure of that which in accordance with reason he had gained for himself. It was not requisite for this end that his ideas should be perfectly clear; it was sufficient, that he remembered with displeasure every encroachment made upon his rights, perhaps even those, likewise, which had been made upon the rights of his friend, in order to give his approbation to the protecting law. But this law was also directed against many desires which he might himself feel to appropriate to himself the property of others. He would now be restrained by that law, but not by its menaces, for he has himself already approved of it; and he must now possess, although but dimly, a feeling for the reasonable demands towards which he should aim. The more the social arrangements are developed, securing the rights of each individual man, the stronger grows the inward consciousness of right, and this supports the laws. It originates in the inner mind of man; but it is awakened and strengthened by being outwardly realized. Therefore the regulations for upholding the laws, and the disposition to approve them, strengthen one another, so that the security becomes greater, although the punishments are made less terrible.

Something similar may be said of the other dangerous propensities of man. What a desire of vengeance exists in him! This desire is often a natural feeling for justice, but its abuses are fearful. The laws place a barrier to it; they protect one man from the vengeance of another, but when justice requires it, they further offer a satisfaction. However imperfect this may

sometimes be, the universal knowledge of it softens and lessens the desire of vengeance in man. Hence it arises, that the knowledge of this outward reason protecting him, elevates his own rational life, and his respect for reason, which is connected with it.

These examples sufficiently point out many others, so that every reflecting mind will perceive that laws do not only produce an immediate effect, but that also, by unfolding a disposition conformable to law, they weaken and extinguish the force of evil designs, even when they are the most extravagant; and should a whole people simultaneously disturb the existing regulations, this disposition yet strengthens those who labour for law and order, and does not allow itself to be entirely extirpated by those who are seized with a mania for destruction, but often restrains them, and indeed calls them back.

If, therefore, we now consider that laws have, we may say many thousand times, prevented various crimes, and that therefore the foresight of human lawgivers has often, for centuries, indeed thousands of years, prevented the abuse of the free will of man, we thus see the possibility of his actions being governed without his being himself oppressed. The direction which laws have given to the free will of man, in many respects beneficial, has been no oppression, for he is free, and can resist the laws; but even when he goes astray he is still the expression of a rational being, who cannot entirely escape from Reason and from respect to the surrounding government of Reason.

However small we may esteem all that human wisdom has here accomplished in comparison with that which is performed by the divine government of the world—I agree most entirely with this:—yet multiply this performance of the limited wisdom of man, with Infinite Wisdom, and you will find the result of the calculation to be, that the infinite wisdom of the eternal almighty God is able to guide everything without making casual alterations. Do not let us be disturbed, because much remains in the government of the world which we cannot conceive, because the finite being cannot grasp the Infinite in its totality, indeed that it is only able to comprehend some of its great features. Those who believe in an arbitrary government, are accustomed to bring forward examples which cannot be explained by the universal laws of existence. It is very possible that the events thus selected may be inex-

plicable to us with our present knowledge ; indeed it is not difficult to find instances of event, which can never be explained by human knowledge ; but such inexplicable things cannot refute a mode of comprehension which, in accordance with its nature, does not pretend to explain each individual event. When our opponents triumphantly bring forward inexplicable events, we can reply to them :—In common with us, you cannot understand these events, but you fancy you understand them ; you believe that you are initiated into God's decrees, and speak accordingly : we know that we do not understand them, and openly declare it. They may perhaps assert that they are guided by religion ; that they judge by the will of God revealed to them by religion ; but only let them shew us a single instance of an event where it can be applied without the addition of some of their own wisdom.

History has been often treated in such a manner that it presents the most extravagant inventions of the direct interference of God in the course of events ; but the more the historian understands his art, and exhibit things connectedly, still more we learn from him to understand the laws by which the events of the human race and human society are directed. Former times have bequeathed to us several historical works composed in this spirit, but at no period have there been so many and such general demands for historical representations, or such means to fulfil them, as in the present day. Our mode of contemplation is far from denying divine influence ; on the contrary, when it accounts for the laws by which events happen, for example, those by which the Roman empire fell, the Stuarts were banished from England, and the North American states were formed, it presupposes that these laws originate in the will of God, in consequence of the eternal nature of this will, not in consequence of arbitrary decrees produced by the errors of human freedom. It is acknowledged as an unavoidable imperfection, that we cannot explain each individual part in the laws deduced from the history of events ; but it is affirmed that neither intellect nor true piety gains anything by attempting to conjecture the designs of God in incomprehensible events.

Many imagine it is a greater comfort to suppose we are under the protection of a master who, humanly speaking, has a constant watchful eye over us, than if we only place our

trust in the eternal laws of the will of God. It appears to me that this opinion rests upon a misunderstanding. I will first examine it by an example taken from earthly circumstances. Let us imagine a man who intends to make a journey, and that, with regard to the road he has to travel, he must choose between two which lie in different countries; in one personal safety rests upon wise laws, and in regulations appertaining to them; whilst the other is so constituted, that it has been impossible for the prince, although wise, powerful, and good, to introduce the same laws as in the former state, though he is ready to remedy this defect by giving the traveller a strong watch for his protection: in which of these two countries can he expect to travel with the greatest security? We may easily apply this to the two methods of representing the government of the world. The one assumes that the reasonable management of the world is sufficient to give us all the security which is really found in existence; the second requires the assistance of arbitrary inspection. In order to judge correctly in this case, we must above all remember that we must not demand a more secure protection than that which is in reality met with.

It has often appeared to me, that those who do not find in their first comprehension all the security they desire, require a far greater security than what in reality exists. We should misunderstand that mode of comprehension if we did not remember that security does not exist in consequence of an accumulation of the scattered laws of Nature, but by means of legislation in its entire connection and order, determined by eternal Reason. When Martensen* says, "that we are everywhere surrounded by supernatural holy powers, which are able to influence nature apart from God," we may, if we wish, comprehend the meaning of his words, by the more particular explanation, that we then understand by nature, finality alone; not the whole of nature, of which however finality is but a revelation. It would not be impossible to imagine that higher endowed beings formed a part of the eternal reasonable arrangement, who, unseen by us, watch over inferior beings like magistrates in the government of a state; but the experience which we possess of what really happens, does not appear to demand this idea. We certainly often hear things related, which would be

* Professor of Theology at Copenhagen.

inexplicable, if we did not believe in higher arbitrary arrangements; but that anything is inexplicable without a certain presupposition is generally a very weak proof of its reality. We can only safely come to this conclusion, where we are certain that we penetrate all the possibilities concerning the thing; but this is not the case here; for there are innumerable conditions and events whose importance for the welfare and happiness of individual man, we cannot explain out of this presupposition. Here belong all those effects, which in consequence of universal laws, act upon innumerable individuals. The same storm passes over great tracts of land and sea, destroys ships, tears up trees, throws down houses, throughout following the same laws. Sometimes floods have desolated great tracts of land, and in one night consigned many thousand human beings to death. Earthquakes have produced as universal destruction. The same drought, the same untimely rain, the same severe winter, happens to all the inhabitants of a great extent of country. Now we can, and must believe, that the effect of all such events which happen in common to very different people, belong to the universal harmony of reason, but we must at the same time confess our want of capacity to comprehend the individual parts of the event. If there is therefore such an unexampled overpowering number of such events which we cannot explain, how can we arrive at that conclusion? It will perhaps be said, that it is exactly this great sum of inexplicable events which compels us to believe in an arbitrary higher interference; but if we believed in this pre-arrangement, and attempt to comprehend the possibility of an arbitrary perfect power which balances all the contradictions which the oneness of the occurrences has here brought together, we shall certainly feel our weakness. Then let both parties confess their incapacity to comprehend this part of existence, and let not the one attempt to procure an advantage at the expense of the other, by merely pointing out his incapacity.

I know that there are many who from another point of view will be dissatisfied with the mode of comprehension here defended. In consequence of this idea, they think that God has no more to do, after he has created the world. Although this is unimportant as an objection, and although I believe we should rather consider the comprehension of the eternal government of Reason, than enter into

inquiries about the nature of God, I must still show out of what a misunderstanding the comprehension here defended originated. It presupposes, namely, that God only once acted and then ceased; in place of which he constantly acts, and constantly makes laws; were it possible for this to cease, the world would immediately cease; he incessantly creates the entire infinite manifold existence, and this lives in him. The human notions of repose, fatigue, &c., which we can never apply to God, have nothing in common with these views.

3.—*The development from the lower to the higher.*

In the Remarks (p. 299) the question is put: "But why is it a law of reason that everything should proceed from the irrational, even from what is contrary to reason?" I answer, that I never admitted this. On the contrary, the connection shows that it is my opinion that all things in existence proceed from something undeveloped, to pass through an imperceptible series of developments. If I am now asked why everything in the world proceeds from something in which the reasonable is concealed like a hidden germ, I answer, that I need not explain why reason is as it is; but that it is so in nature, will, I think, in vain be denied. Each individual man first begins his existence as a wholly unconscious embryo, and after birth as an irrational infant. If the author of the Remarks will apply this to the human race in general, he will not find it contrary to experience. He is certainly of opinion that history should point to an original state of perfection. At p. 300 he says,

"As far back as history reaches, we never find that a people have extricated themselves by their own strength, from a savage and barbarous state, but the elevating germ of civilization was always brought from other countries where it already existed; even where it met with such a favourable soil in the new locality, that it far surpassed the tree from which it was taken. We can imagine the imperfect gradually developed to greater perfection; on the other hand, I confess that I can never bring myself to think that, in the natural order of things, life is developed from that which is contrary to reason, or the good out of the evil."

I must here remark that history (I do not say legends) does not go so far back as the earliest civilization of nations. The reciprocal influence they exercise on one another is lost in the dark ages, of which we gradually learn to divine something by the aid of their languages, the similarity of their

legends and their opinions ; but we hardly ever arrive at the first steps of civilization. But if we admit that the germ of reason in the earliest race of man lies hidden as in the child, we by no means admit that the rational is developed out of the irrational, but that a conscious reason is developed out of something of which it is as yet unconscious. According to this mode of comprehension, there existed no separate higher developed reason in the earliest race of men, from which intellectual cultivation could commence ; but the assertion that this must be a necessary condition, appears to me incapable of being proved. According to natural laws, the reasoning powers of man must be developed by reciprocal intercourse with the exterior world ; when he perceives an object with his eye, he stretches out his arm towards it like the child ; after various attempts the remembrance of the impressions received by his sight, and the forms and distances which he has discovered by his senses, will be impressed on his memory, and his reasoning powers will produce thoughts concerning it. The different animals will each make a peculiar impression upon him ; he will receive the same kind of impressions from the same species of animal, but dissimilar from different species. His memory preserves these impressions, his reasoning faculties cultivate them. It is naturally the same with all other objects : plants, stones, &c. The more highly endowed among mankind will first develop themselves, and afterwards extend their influence over others. Man, in obedience to his instinct, is impelled by certain impressions, to produce sounds. This is even the case with animals, but in consequence of his higher faculties, man distinguishes them more accurately, preserves them more perfectly in his memory, and uses them to express his feelings and his thoughts. It is not necessary to discuss here how many ages may have elapsed, before there arose from this a tolerably comprehensive language ; it is sufficient to see the commencement of the path. If we now observe what has happened in the historical period, it will perhaps be impossible to find a people who have not had some other nation as an instructor, but no one will deny that there are numerous examples of men who have discovered new truths, and who have everywhere made new mental progress. This indicates that such must have been the case before the historical period, and perfectly agrees with what we have seen, that the

human faculties only require the influence of the entire universal arrangements of reason, founded upon the divine nature, in order to develop themselves.

Theologians have been generally very much inclined to believe that nature itself was degenerated by the fall of man; but this opinion cannot be combined with the determined knowledge that we possess. It is certain that, before man was created, the laws of nature were the same, that matter had the same properties, and that the living beings were subject to suffering and death. I have said things with reference to this in many parts of my book, and especially in pp. 125-127, but very briefly, because I regard it as an acknowledged thing; but I feel myself now called upon to say that our numerous investigations on the interior structure of the earth, and the laws of its development, have shown, that long before man came into the world, many great and destructive changes had taken place, in which whole species, indeed whole races of animals, perished; that in those times also many animals swallowed one another, and indeed in the bones of the earliest creatures distinct marks of disease have been traced. Such are the clear proofs we possess that suffering, destruction, sickness, and death are older than the fall of man! If any part of the Bible appears to contradict this, it may undoubtedly be reconciled by a correct interpretation; but should the contrary be the case, which I do not believe, we must leave such passages as unexplained mysteries, until a higher knowledge is attained. I leave it to dogmatists to consider how far their doctrine of sin may be regarded in every way as indisputably correct, or whether they would profit by a further investigation.

4.—*Some explanations in reference to what I have said about Faith.*

In the Remarks (p. 309), it is assumed, that in what I have said in my book (pp. 126-127) on faith, I have really had in view the so-called faith upon authority, but this was not my intention. In the Remarks, a passage from my book is certainly quoted in part, but with some alterations of words and with omissions. I refer the reader to the passage as it stands.—(See p. 127. "With respect to much," to "for truth").

By faith upon authority we must, I think, understand a faith which has its foundation in a blind submission to the opinions of others. It appears to me, that the word *faith* is ill applied here, and that the term *faith upon authority* should be more especially considered in the light of an opinion. He who allows himself to be guided with regard to disputed scientific opinions by the views of great men, may be accused of holding faith upon authority. It may also be difficult to distinguish everywhere between this blind faith upon authority, and the rational confidence which we place in the knowledge and love of truth in others, where we ourselves are not able to inquire. Happily, the case here does not require this sharply defined boundary: no one will apply the term faith upon authority, to a faith which is excited in individuals by the communications of the Prophet of the human race, which really reveals "that which before was hidden in the fathomless depths of his own nature."

Hence, an embryo faith is the necessary consequence of the rational nature of man. If we were merely to call this embryo faith a faculty of believing, it would not sufficiently express its true condition: it is a disposition and a necessity to feel a conviction of the truth of the Reasonable, although it is not brought under our cognizance. The more comprehensive the unity of reason of which we are treating, so much more intimately is it connected with our own nature, or perhaps more correctly speaking, so much the more numerous are the points of union in which the unity of reason, which stands before us as an object, amalgamates with our own rational nature. Our expressions are far too poor to say at once, all that ought, if it were possible, to be at once expressed. In the expressions which I have used, we shall feel ourselves tempted to raise our thoughts only to the form of Reason, but both the rational within us, as well as the rational without us, is an act of Reason. It is only the imperfection of our intellect that causes us to make a distinction between the eternal creative power and eternal reason; in reality they are inseparable. The creative power gives the thing its action, reason gives this action its form, which comprises in each thing a variety of subordinate forms, just as an idea can conceive in itself many subordinate ideas. If we turn to our own essence, we must then acknowledge that all its faculties

taken together constitute *one* work of the eternal creating Reason, or rational creative power, both expressions denoting the same thing. If we now view God as that essence, of whose being we must be convinced by our own essence, we must then bear in mind that the former as much as the latter is an entire living Being, though in every respect infinitely more glorious. From Him we receive, through the whole of existence, innumerable influences; but our conviction of this springs from the intellectual faculties of our nature. By the hidden power of all these united effects, the knowledge of God is awakened within us. Some people have such a strong internal life of reason, that this consciousness is very easily excited; most people require many and powerful means of excitement; to these belong communications from other independent beings. Were such only believed as communications, a faith upon authority would alone be produced, which is almost useless to our rational existence; but if these communications awake those hidden faculties of the mind which are adapted to faith, so that these are developed into a lively consciousness of God, and the consequent endeavour to live in God, then this faith would never be designated a faith upon authority. When our reason, acting with consciousness, endeavours with all its powers to comprehend the connection between the actions of the God we believe in, and all that is effected, a force and clearness of conviction proceeds from it, by which, as I might say, faith is changed into knowledge.

From this exalted subject we will now turn our attention for a few minutes to the conditions by which faith still more easily passes into knowledge. The consciousness of what virtue and duty are, undoubtedly begins with the human race, as it does with each individual man, in faith. For example, we feel the duty of speaking the truth long before we can prove that it is necessary for the human race; indeed, it would be a sad thing if we did not discover a strong love of truth, and a sincere veneration for this virtue, among all estimable men, although among millions only individuals are met with, who have turned this belief into knowledge. I must still add this remark, that we must not confound this true knowledge with the nominal knowledge which is occasionally acquired by finely imagined proofs, if along with it we lose sight of the source of existence. The knowledge which we possess of a virtue must be rather founded upon natural faith, than

on itself; otherwise it is dead and powerless. What we have said, of *one* virtue may be easily applied to others.

5.—*Reason hidden in the powers of the Soul.*

In page 314 of the Remarks it is said :

"It appears to us as if the author had kept exclusively to the notion of 'Reason.' God is certainly eternal Reason; but our notion of the Divine Being does not end in Reason; not even our notion of the perfect man, for man has also Imagination and Feeling; and although these cannot exist where there is no Reason, and here especially there should be no separation, as if the one could exist without the other, yet the mental nature of man is not sufficiently designated in the word Reason."

I hope that after all I have said, no very great explanation is necessary in order to show what I understand by the word 'Reason,' although I may appear to give it too much importance. Thus, I conceive that there is eternal infinite Reason, which comprehends all the laws of existence; through it everything receives its whole individuality, its whole form, taking the word in its most comprehensive sense; but that which bestows being on things, is the creative power; inasmuch as this power acts under different forms, it has its individuality in each case by the law of reason, or the sum of the laws of reason, according to which it acts. So I think we are to understand, when we talk of creative powers. Besides, the creative reason, and the creative power, are not really two separate things; we are only obliged by our reasoning powers to separate them while under our observation. When in speaking of man, we attribute to him Reason, Imagination, Feelings, we use the word 'Reason' in a far more limited sense. It is the same eternal Reason which gives form to our intellectual creative power, and its mode of perception to our faculty of receiving impressions; but both in imagination and in feeling it acts unconsciously, namely, without the intervention of the legislating faculty of reason; in human reason, on the contrary, it appears conscious of its own nature. In the same way Reason acts secretly and unknown in the other faculties; that it does so in the sense of the Beautiful, I have endeavoured to point out in many investigations; and must we not confess that conscience is likewise an inward feeling which is able to guard against the unreasonable, and justifies the reasonable, even in

innumerable cases where we do not perceive the whole condition of Reason? It is hardly necessary to say that *each* of our faculties is also in conscious co-operation with Reason.

I have not here endeavoured to give a complete representation of the divine nature. I have not ventured upon it. I will not either attempt it, but only say that when we form our idea of God from man, as is frequently the case, his idea must contain all that is glorious in the human being, but with infinite power, fulness, and perfection. We must, however, be especially on our guard against the errors which may creep into such attempts, when we are apt to attribute properties to the Divinity which far too strongly bear the stamp of human limitation.

6.—*God and the World.*

It is said in the Remarks, p. 313:

“In what we have last said, we have deviated slightly from what actually belongs to the paper before us. We return to it, and repeat that our principal divergence from the author consists in this, that he has, as it appears to us, unjustifiably identified the nature of this world with the eternal order of reason, which is doubtless revealed elsewhere, but in our nature is obscured and disturbed, and cannot be again self-restored. It is therefore our belief, that Eternal Love was desirous to restore it to this world in a supernatural manner, and farther will restore it, but with conditions of independence granted to the finite rational being. It is not a human invention, but the distinct announcement of Christianity, that “God has reconciled the world with himself through Christ.”

To this I answer, I have endeavoured to show in a far more comprehensive manner than has been done before, that the eternal order of Reason reveals itself through all finite existence. Theologians certainly teach us that God has created and wisely regulated the world; even in many of their combined ideas, they mention how it is regulated with infinite wisdom; but their attention is generally so occupied and carried away in other directions, that they bring it less clearly forward; and this effect has been most particularly produced by their views on the misery and fall of man, introduced by sin. The opinion that man's sin has corrupted the whole of nature, is entirely opposed to the distinct evidence of natural science. It is quite certain, as we have already shown, that the laws of nature were the same before the fall as they are now; man even in his state of innocence is represented as designed to take nourishment and to multiply his race. The

naturalist cannot doubt that the human body was constructed in the same manner in the beginning as it is now. To bring the thing more vividly before us we shall mention some of the principal arrangements of the human body: there must have existed then, as now, the heart, the circulation of the blood, and respiration, muscles for the movement of the limbs, nerves to excite the action of these muscles, and to receive impressions, as at present; the nerves of the senses must have had their origin as they now have in the brain, and have distributed themselves thence to the eyes, the ears, the nose, the mouth, &c. &c. If any one were to deny this, we certainly should not be able to bring forward any proof which could convince those who do not understand the connection in nature, which is proved by science; but it is not necessary to be a naturalist to feel convinced that the whole animal kingdom, from the earliest times till man arose, and later, even to our own days, has developed itself according to the same laws, and that the human body is comprehended in this connection. There is nothing which can lead us to the opinion that man was altered after the fall; this has perhaps been asserted by no one. We must therefore rest upon the destructive influence which sin has exercised on the spiritual powers; and even here we must guard against exaggeration by remarking how man, already in his state of innocence, showed that he was as easily seduced on the side of piety, as he was beguiled on the side of his understanding.

I have already attempted to shew that the world is in its nature perfect; and that as a divine work it must be so; but since man, in consequence of his limited powers, easily adopts a mistaken view of the world around him, and so much the more, the less he strives after the divine light, the world appears to him, as something separate and apart from God. So the world appears *through the guilt of man*, but not corrupted and destroyed in consequence of its own nature.

I must beg the reader to compare here, the short notice, which I have given in p. 121, and the following pages.

Neither Christ, nor any of the biblical writers who benefited by his oral instruction, have mentioned the corruption of nature by the fall. When we therefore refer to the Bible, we must rely on St. Paul alone. I will leave it to theologians to determine the right interpretation of his expressions; it appears to me that he only intended the abuse of nature, on

man's part, and the great improvement in our nature which must follow from the improvement of the human race. A comprehensive realization of this thought can only exist in a very distant future. Most of what theologians teach us, of the corruption of nature, does not appear to me to be so clearly and decidedly brought forward in the Bible as in their commentaries, and that it derives its origin from mistaken philosophical investigations. I will not lead the reader into long disputes on this point, but rather prove my opposite convictions with the grounds on which they rest. The whole world was always finite; and no one ever believed that it first became so by man's sin; but all finite existence is by its nature imperfect. Every finite object is limited and transitory, and when viewed separate from its connection with the whole of which it is a part, we have sufficient cause to lament over the imperfection of the Finite; but if we do not only regard the individual objects merely apart from the whole, and—if I may so express it—as if it were their duty to be independent, we shall be led to another mode of contemplation. The more an object constitutes an exclusive whole, the more we see in it the revelation of eternity. In the totality of the Finite we first see the revelation of its eternal origin, so far of course as it is possible to see it from our point of view.

It appears to me that those who have zealously brought forward and depicted the misery of the Finite, not excepting the profound thinker Pascal, have failed, because they have placed the thing in a false point of view; they spoke of the Finite as if it ought to be the Independent and the Eternal, and therefore showed how infinitely it is removed from it. Pain, death, and destruction are spoken of as the fate of all finite beings, and I am asked if I consider all this as nothing. I reply that all this is sufficiently felt in finite existence, but I doubt that any one can prove that it ought to be different; whereas our consolation in this finite life must be our hope in a life of infinite duration. But if existence, properly understood, is an undisguised revelation of the Divinity, it is of the greatest importance that we do not misunderstand this, but, on the contrary, that we should vividly apprehend it, and take a lesson from history, which proves to us how the human race, in the most different periods of time, and amongst entirely dissimilar races of people, has received instructions from these revelations. An intelligent use of this know-

ledge will serve to strengthen us in our happiest convictions, and at the same time elucidate and purify those opinions which are mixed up or obscured with error.

Postscript.

While I read here in print what I have said (p. 188) on the relation between the Finite and the Infinite, I think that some further explanations are desirable. Let us first imagine the intellectual image which a man of small or slightly developed faculties, must form to himself of existence. This image will comprehend little more than the necessities of external life, and the human relations most nearly approaching it. Whence the benefits proceed which he receives from society, he scarcely knows; he has a still less clear idea of the arrangement and government of the state; of course therefore we cannot expect a survey of the population of the earth, and the reciprocal intercourse of nations. Let our thoughts now turn to the picture which a well-informed citizen, or merchant, paints of existence; this will nearly comprise the objects which we mentioned as excluded from the former limited view. Much which there was crude experience, in which man saw no thought or connection of thought, becomes, from this higher point of view, part of the human world of thought. Let us now proceed further, and imagine the picture which a man of great knowledge and worldly experience, forms of existence: the connection of reason which we have discovered in the course of the development of the human race, and in the events of time, stand clearly before him; his world of reason is now far more comprehensive: however large may be the mass of experience which his thoughts can embrace, it is of less importance in relation to the reason revealed in him, than was the case on the lower points of view. Let the same man now combine with this knowledge, a general view over the arrangement and the laws of the material world, and his conception of the world will be still further enlarged.

There may be various degrees of this, but we will pass over most of them, and imagine that he sees the events of the human race in their inward connection with the operations of nature; how large and important now will be his rational view over the whole of earthly existence! Let us still

make another great leap in our ideas, and imagine that he possesses a deep insight into the whole structure of the world; now again much which was formerly a mere experience to him, will form itself into an idea, and thus his rational view of the world will be wonderfully increased. We shall now pause, to make the proper application of all this. It is evident, so far as a man perceives the necessity of Reason in what he has experienced, it will not appear to him as something merely Finite; he sees in it a portion of the Infinite. Inasmuch as all perceptive existence stands before him as a kingdom of reason, in the same proportion he comprehends its eternal, rational being. But this transition of the inhabitant of the earth into eternal existence is nevertheless infinitely limited, partly by the limitation of his faculties, partly by the inevitable influence of the external world. It is certainly in his power considerably to strengthen his rational existence, and to allow the impressions of the external world to have a smaller influence upon him than it usually has upon the multitude; but he is very far from becoming a completely free citizen in the world of Reason.

It will not now be difficult to perceive that the Finite must entirely disappear before God, who sees things at once in their whole rational being, and who is not subject to the influence of the senses in their finite form, but only knows them because the creative powers, whence they derive their existence, live in his consciousness.

ON THE
INTELLECTUAL INFLUENCE EXERCISED
BY NATURAL SCIENCE
IN ITS PRACTICAL APPLICATION.

*A Speech delivered at the Opening of the Polytechnic Institution,
on the 5th November, 1829, in the presence of King
Frederick VI.*

MOST GRACIOUS KING,

THE Institution whose foundation we are now celebrating is one of those which have been called into existence by the intellectual development which has been latterly exhibited in Europe. Such establishments for instruction have been either introduced, or are in process of introduction, in all enlightened countries. Your Majesty was desirous that Denmark, which holds such an honourable place in enlightenment and intellectual development, should not be behind-hand in this instance. Your paternal eye was directed towards these Institutions from their very commencement; and as experience has confirmed the hopes which were then entertained on their behalf, you determined to add this important link to the chain of beneficial plans, in the promotion of science and the arts, and general education, for which Denmark is already in your debt.

It is a pleasant and agreeable duty, which my office imposes on me, to be the speaker at this festival. I venture to say that the lot could have fallen on no one who is more convinced of the importance of the object, or more desirous for its execution. How sincerely do I desire at this moment to possess the skill and eloquence which might correspond with the ardour of my wishes.

I am aware that I am about to speak before the king, and in presence of the princes of the royal family, and before so many enlightened citizens of my country. How can I expect

to satisfy the demands which such a festival brings along with it. It is only the consideration, that it is my office which claims my services out of the actual circle of my ordinary duties, which inspires me with confidence that credit will be given for my zeal in the important subject before us, even if my powers should be otherwise found too small for the task.

Europe has already decided by the testimonials of general experience, on the importance of those different branches of natural science, which enter so intimately into all the departments of the state government, and of the utility of institutions for their distribution. Should there, however, yet remain a doubt, it is no longer the time to contest the point with words, as we indulge the more certain hope to be able to do so now with deeds. On the other hand, I will attempt to draw attention to one side of the subject which has hitherto been little noticed, namely, to the great influence which such an Institution as the one now under our consideration must exercise on general education and enlightenment, and which will at the same time show that this mental development must also tend to improve the industrial arts and trades, and especially contribute to the welfare of the whole community.

Experimental natural science, by which the efforts of our institution are almost supported, cannot boast of a venerable antiquity. It is contented to hold a place in modern science, and rejoices in the recollection that it was born during the great period of the regeneration of the sciences; but precisely on account of its novelty, the influence which it has hitherto exercised is but small in comparison with that which we may expect from it in future; partly because it is yet far removed from that internal perfection which it is possible that it may attain in the course of several centuries; partly, because mankind have hitherto only appropriated the least of the benefits which it offers. I have no hesitation in asserting this, in spite of the great improvements which our science has produced in all that concerns our material comfort, and by which Europe during the last few centuries has acquired an entirely new aspect; but it applies with still greater force to the actual subject of our discourse, namely, to the influence of experimental natural science on the development of the mind. It is indeed true that what has been already accom-

plished is not to be regarded as unimportant. How much has it not contributed to banish superstition. Even though it may sometimes have happened that an exaggerated zeal was called superstition by many, who, at a certain stage of knowledge, were not able to comprehend the cause whence it arose, still the extirpation of that mental malady is no less a benefit worthy of being remembered. For to ascribe to a powerful irrational being that which is produced by the eternal order of reason, or to ascribe to the powers of darkness that which comes from the Father of lights, can never be united with good. No; the dominion of superstition is injurious to all, from the prince to the lowest subject.

Far more important, however, is the intellectual influence exercised by science in the variety of her discoveries in which a superficial observer would only perceive new knowledge of individual natural wonders. When, however, the circle of man's corporeal vision was enlarged by artificial optical instruments, did they not at the same time enlarge his mental vision? For must not his idea of existence have been immediately extended when he learnt that the planets are heavenly bodies like our own, some of them accompanied by moons similar to ours, and alternating with day and night, summer and winter, as on our globe? Must it not have awakened a new conception of the hidden glory of nature, when the same variety of form and movement was perceived in the smallest portions of bodies, as men had previously been in the habit of beholding in a space of considerable extent? What a sum of accurate ideas have been spread among mankind by the discoveries of the last two centuries on the atmosphere; since the barometer has proved the pressure of the air, and then assisted us in determining the heights of mountains, and the depths of wells; since the air-pump has taught us to ascertain the condition of things in a vacuum; since the balloon has carried men through the air far above heights to which the eagle can soar; since the specific gravity of the atmosphere has finally convinced us that it shares in all the properties of matter! How often the thermometer has corrected the mistaken indications of our sensations, and brought us to the knowledge, that both the opinion that in past days mankind enjoyed a milder climate, or that they endured a severer one, is wholly groundless; and that nature has preserved the same sublime com-

stancy in her path with regard to heat, as in all her other works? But I should wander too far from my subject, were I now to mention all the explanatory instances which are presented to us by the doctrine of heat. But I will not occupy more of our limited time in quoting examples. If I only mention the electrical machine, the lightning-conductor, the steam-engine, the prismatic colours in the rainbow, the celebrated discoveries of Galvani and Volta, every man will at once feel many chords struck in the harmony of his knowledge, and will easily complete what I have here alluded to.

But great as is the importance of all this, I yet venture to repeat my assertion, that our science has only begun to show the influence that she may possess, in the development of the human race.

I hope that our enthusiasm for the intellectual influence of the natural sciences will not be found an empty and groundless zeal, but a well-founded effort in the development of the present epoch. Other sciences have hitherto guided the mind of man on the path of its development, with preponderating influence, almost bordering on sovereignty. We will not forget the great things that they have accomplished. We will not entirely quit our former teacher, as if he were grown old and useless; but we will also not overlook the fact, that each development, taken in itself alone, is one-sided; and that this one-sidedness, if brought to an extreme point, becomes dangerous. If we except those rare individuals who can mature the very deepest knowledge, a certain amount of one-sided perfection and refinement leads to exaggeration, which again easily passes into slackness and satiety. In this condition we grasp at the supernatural, the unnatural, and at sickly exaggeration, and we despise the true, the simple, and the wholesome. Our own period offers distinct traces of this false tendency, and would offer many more, had not natural science sown a seed during the last two centuries, which has not been wholly fruitless. It places an invigorating knowledge, founded on countless experiences, as a barrier to the weak extravagances of enthusiasm, and had it not been as firm and indestructible as it is, we should have already beheld astrology, magic, and all the monsters of the imagination from the Middle Ages, seated on the throne of reason, and supported by a pretended poetical, philosophical, and

religious spirit. Every one who has watched the signs of the present day, and is acquainted with the lessons of nature, will feel how much has still to be accomplished; for nothing can strengthen the soul so much as the great truth which this science does not only teach, but proves,—not merely proves, but places clearly before our view,—that Nature acts according to eternal laws, and that these laws are constituted as the mandates of an infinite perfect reason, so that the friend of nature lives in a constant rational contemplation of the Omnipresent Divinity. This habit of keeping before our eyes the eternal reason which exists in nature, instils us with a dislike to all extravagant enthusiasm, and fills our souls with a quiet, clear confidence, which inspires mankind with courage and ardour for important undertakings.

There is also something really refreshing to the mind, in the increasing progress of natural science by various discoveries. It brings every year new delight to the friend of truth, and never allows error to establish herself. How many victories has not the natural science of our century gained in this respect for the cause of truth. There was an entire school, composed in part of very intellectual men, whose efforts for the promotion of science we cannot but acknowledge; but who, in the most rash and youthful arrogance, would have overturned everything. They endeavoured to cause experimental science to be viewed as an object which was dead, and which had not sufficient power to compass nature. How then has our science asserted its rights? It made a series of discoveries on light, on the metallic bases of earths, on the mathematical relation in the combination of the elementary parts of matter, on magnetism, &c., in which these deriders of science had discovered nothing, though they had indeed dreamt of much, which little suited the newly discovered facts.

One most important peculiarity of the intellectual influence which is imparted by experimental natural science, is, that it leads to action. The tendency to dwell in general observations and in mental contemplation, is especially visible in those countries where experimental natural science, particularly the experimental part, has only lately begun to have an influence on life, while other branches of education have been brought to unusual perfection. It certainly would be lamentable if, throughout a whole nation, there was no one who resigned

himself solely to an intellectual life, if I may so express it; but it is not indeed adapted to every one, since where it is aimed at by many, it generally becomes an artificial dream, which leads people away from the mental and bodily activity which constitutes human life, and from those efforts to impress the stamp of Reason on everything surrounding them, towards which most people are called, and by which they can, in various ways, adorn their existence.

Our Institution enables the cultivated man to become acquainted with the powers of Nature which are made use of in manufactures; it offers him practical instruction in chemistry, in the art of drawing, in the use and application of mathematics, and in the study of machinery; it opens workshops to him, in which the most important mechanical arts are taught; it gives him a general survey of all the manufactures, and their mutual relation to each other. The young man who possesses some talent and industry, by aid of the preparatory knowledge and expertness which he will here gain, will easily succeed in whatever business he may select. He will indeed still have to pass through the school of experience, but he is spared the year of apprenticeship, which has frightened away so many cultivated young men from business, to the great injury of the progress of the country in the industrial arts and in prosperity. How few there are in our kingdom who venture to spend their means on industrial skill! They are right; for they neither understand how to form a plan respecting it, nor are they capable of judging of the proposals which are laid before them. But if natural science and its application were viewed as a study which was suitable alike to young men of higher stations in life, this incongruity would soon cease, and many would find a new and useful occupation.

It has not escaped the notice of your Majesty, that many persons in office would have been far more fitted for the duties imposed on them, if they had possessed that kind of education of which we are now treating. You, most gracious King, have been desirous, by the foundation of this Institution, to provide for this important division of the administration. It is quite evident that languages, legal knowledge, and practice in Chancery, do not afford all the preparatory knowledge that is requisite for the holder of those offices which are intimately connected with, and have a direct influ-

ence on trade. At the best he acquires, at a later period, and but gradually, the experience and the knowledge in which he is deficient; but if he has no taste for business, he will be easily led to look down on it, as a thing beneath his dignity to notice; and it is much to be feared, that he will not only neglect that which may promote it, but that by wrong directions he will also stifle in the commencement much that is useful. Whilst he who, with diligence and understanding, has benefited by our Institution, will bring to his post knowledge and a love for business, and will soon complete by experience, that in which he then is wanting: he will frequently be the kind and rational adviser, where another would only have been the man in office; by his respect for industry, he will contribute to remove the undeserved contempt which is such an obstacle to its progress; he will reply to the questions which his sovereign may lay before him relative to trade and the welfare of the people, with a thorough knowledge of his subject, and will be enabled to make useful proposals, not alone for the removal of impediments which still oppress the industrial arts, but also for new means to elevate them.

Men who have thus acquired a living and practical knowledge of natural philosophy will spread a taste for it in their own circle. No science affords more opportunities for daily conversation and communication; the objects lie so closely around us, they offer so much variety and novelty, they are so attractive by their utility; finally, they do not so easily involve mankind in quarrels as other subjects of reflection, which sometimes encourage dispute by their uncertainty, and sometimes by the share which is taken in them by human passions. This distribution of a taste for natural science will afford an opportunity for the natural history of our country to be inquired into more narrowly, for its productions to be better employed, and for foreign discoveries to be more rapidly circulated.

That which was formerly alone designated as education must always remain unknown to the greater proportion of the labouring classes. Our science is more accessible to the artisan; it is more within his reach on its material side, if I may so express it; and from its intellectual nature, which scarcely requires any extraordinary preparation, it elevates him and gives him a higher intellectual cultivation. A certain degree of the education which is usually given, is apt to lead

many of the labouring classes away from their object in life; it makes them dissatisfied, and gives them a distaste for their daily duties; it entices them to employ themselves in arts and sciences which they are neither able to understand nor to use; it even, indeed, leads them to take part in religious and political controversies, by which they are changed from being useful members of society, to useless and even injurious ones. Our science leads the artisan to his business: should he have superior abilities, and that restless thirst for action which usually accompanies them, he then sees immediately surrounding him a wide field in which his mind may revel, and where he may earn riches and honour without running the risk of being scorned, and of making himself ridiculous, or even of being involved in culpable enterprises.

I am aware that many of the most enlightened and most learned men of my country fancy that scientific knowledge is unsuitable, and even injurious, to men in business, and that we should only communicate fragments, or *recipes*, so to speak, of the material portion of science to the labouring classes. This view, held by so many distinguished men, would be alarming, if I did not perceive a balance on the other side, in the conviction of those who have occupied themselves particularly with the improvement of the labouring classes, and who most of them live in countries where it is proved by long experience. I confess that at the first step in my path as teacher, I embraced the opinion which I now defend, but I treated it with doubt, and submitted it to a long trial of experience and reflection. It has not escaped my attention that different people from among the labouring classes, who have employed some of their leisure on science, have become unruly, neglectful of their occupations, and have pursued mere visions; but I never was convinced that we should be justified in ascribing the fault to science. Such people would have otherwise wasted their time just as much on things which they did not comprehend, whether they might have chosen as the object of their unfortunate activity the *perpetuum mobile*, or the constitution of the State, or religion. In short, there are some men who have a natural capacity to pervert everything they touch, and who could hardly be improved without recommencing their education. But we should make a great mistake were we to believe that these kind of men were only to be found among the less

refined classes of society; they are found everywhere, even among those whose station demands a learned education. But in the present case it is evident the misfortune does not proceed from too much learning. Science is often represented as too difficult, and the comprehensive faculties of the labouring classes as too limited. There are many of the laws of nature which are as easy to understand as to apply, and which are within the capacity of every sound understanding; for instance, that all bodies are expanded by heat, that the pressure of the atmosphere raises quicksilver in the barometer, and the water imbibed in the pump; that motion is determined by the weight of a body multiplied into its velocity. Besides, every man is endowed by nature with a proportionate power to comprehend that which most nearly concerns him; and this is why scientific laws are so often employed by the labouring classes in a manner that we did not expect. Experience has also taught me by numerous examples, that a good head, even with the smallest degree of preliminary knowledge, is able to make great use of science, if only diligence is not wanting.

While the labouring classes are to be excluded from scientific instruction, it is at the same time required that the scientific man should discover what use can be made of science in the workshops. He must accordingly draw up rules, whose principles may remain unknown to the work-people. The distinction is then offered to him of becoming the guardian of the labouring classes, but he must decline it both on his own and on their account. It is nearly impossible that the philosopher, even if he should combine practical views with his deep knowledge, should keep his eye open to all the small individual circumstances on whose success or failure may depend any new arrangement in the workshop. Let us even assume that we should find in the man of science the singularly rare, if not impossible, union of all those talents which are necessary in science or in the workshop—for the workshop also requires talents, which only a narrow arrogance can look down upon with contempt;—if he unite, I say, all these natural endowments, how can he find time to use them all? If he is to form rules for the workshop, to be followed by ignorant masters, must he not live in them that he may learn all that is necessary to render these rules comprehensible? If he is to pur-

sue higher science, must he not retire to a solitude which is dedicated to reflection and research? But even supposing the philosopher had drawn up rules as comprehensible as rules can possibly be made, still would not many unforeseen circumstances appear, owing to the ignorance of those who employed them? It is an actual impossibility to foresee all these circumstances, especially when new arrangements are being introduced. There are many complaints of the inutility of rules which are found in books, and they are too frequently either incorrect or insufficient. But the fault often lies in the artisan himself; sometimes from being ignorant of the principle of the rule, he overlooks a circumstance which, though apparently insignificant, is really very influential; sometimes he thinks that he is wiser than the author of the rules,—for self-conceit is the companion of ignorance,—and while he believes that he has made an improvement, he makes use of alterations which are in contradiction with the end intended; sometimes, as we have said before, he does not know how to remedy unforeseen difficulties. It is, besides, almost incredible to those who have not experienced it, what false ideas not only uneducated but educated men mingle with what is imparted to them as the results of natural science, unless they have acquired a certain degree of accurate and connected knowledge of it. In addition to this, the ignorant artisan, from his false notions, easily selects imperfect rules in preference to perfect ones; an accidental circumstance which I venture to say is not only of frequent, but most frequent occurrence.

Were science to exercise a great and comprehensive influence on industrial skill and trade, those even who pursue it would necessarily themselves be drawn into some scientific knowledge. In most cases it is the scientific man who makes great and extensive discoveries for the artisan; but the latter must have scientific knowledge to understand these discoveries and to recognize their value; he must even make a number of small after-discoveries, that he may introduce the principle of the inquirer into the involved labours of the workshop.

The misapprehension of the difficult relation that subsists in the intercourse between the philosopher and the artisan, has given rise to an indescribable amount of confusion. It is time that we should see clearly what is gained by both parties, when they are placed in their true relation to one

another. The philosopher has this advantage in such reciprocal communication, that his attention is thereby constantly turned to the individual facts of experience, which, though himself starting from experience, he yet easily loses sight of, while, building conclusions upon conclusions, he endeavours to raise himself to the highest attainable knowledge. It is a part of human nature that during a long chain of conclusions we are easily led astray, not so much on account of an inward fault, but far more because we overlook the conditions which must be included in order to respond to nature, so that at the end of the chains of thought, we have indeed proved something correctly, only that this something is not found in this particular manner in the great connection of nature. Our science must therefore be diligently brought to the test of experience. All efforts in trade, when we become connected with them, present similar experiences, which are indeed very urgent, and in a certain manner unavoidable. While the scientific man is hence led to notice many things on which theory has hitherto not been able to discourse, he is impelled to make new researches, which now correct, now extend his knowledge; and on the other side, he experiences a new and beneficial pleasure in his science, while he perceives how it embellishes our actual life.

The artisan, by his scientific acquirements, is placed in a position to understand the principles of those things which pass before him, and on that account he is able to accomplish much which was before impossible to him. But this is not all; the higher development which his reason has attained during the acquirement of scientific knowledge, allows him to labour with greater understanding; and to labour with understanding is worth more than all the rules in the world. The natural consequence of this is, that the artisan works with greater knowledge, that he performs his work with love and delight, consequently, better and more diligently. He will feel himself improved and worthy to be numbered among the thinking and enlightened men of his country. He will not therefore blush for his peculiar occupation, and what belongs to it; but will feel more ashamed of the shabby artifices by which many people in business endeavour to gain unjust advantages. This reflection and this noble self-respect will be beautifully combined with the spirit of invention, which is so powerfully excited by our science. The inventive faculty

is inherent to our nature; every moment it calls forth questions which can only be answered by fresh efforts. Many of these are of such a nature that even the less intelligent are able to discover them. Here the artisan has a glorious opportunity to exercise his powers, and to develop the greater or less spirit of invention which may have fallen to his lot. It is this spirit which produces improvements in all kinds of industry and trade. With it alone we shall be in a position to rival the industrial skill of foreign countries. No nation can ever, by imitation only, attain the rank of another. If it desires to compete with a country which improves its trade by invention, it must itself invent, or it will always remain a century behind. It is only by inventive activity that the honourable rivalry and fraternal intercourse is produced, which more and more connects the people of different countries.

Thus our Institution appears to offer an entire system of beneficial influences. The teachers have here the most desirable opportunity to enrich themselves with experiences, and to perfect their science by fresh experiments. The few who are born with talents peculiarly adapted to science, will find abundant means of assistance to lay a foundation on which they may continue to build. The future holder of office, who is one day to have an influence on business, will here gain the knowledge, the facility, and the peculiar kind of intellectual development which is requisite. The young man of education finds a school where he can prepare himself for business, without submitting to the rough treatment which a gradually declining barbarism has hitherto allowed to remain among the different guilds. Those men who have not been favoured by a high education, will here find an opportunity to develop their mental faculties, to improve their power of action, and to raise themselves to a merited distinction. Those who leave our Institution will, each from his position in the country, form new starting-points for the distribution of useful knowledge; even though it may not be their principal object, the national spirit will gradually assume a more practical direction; the spirit of invention will be more and more exalted; the natural productions of our country will be better and more diligently employed; the discoveries of strangers will be more rapidly circulated among us; and by all these united efforts, with the blessing of God,

prosperity will flourish more abundantly, and the love of our father-land, and our duties as fellow-citizens, will be nurtured and increased.

It is with pleasure that we thus see our country continually advancing on the path of enlightenment and intellectual development, and the honourable progress it has already made, in spite of its small dimensions, and in spite of its distance from the centre of Europe. In considering this, we feel deeply grateful to the long succession of Danish sovereigns who, dating from him who founded our university, have, with such true patriotic zeal, established so many institutions for the promotion of education; but it is not, most gracious king, because your benefits concern us so nearly, or because your philanthropy and condescension have won all hearts, that your majesty is accompanied by the gratitude of your people. No! impartial history will one day confirm the truth which we utter to-day, when it relates that Frederick VI, already in his youth, when standing beside the throne, was the benefactor of his country, who powerfully used his influence to break the chains which kept the peasantry in servitude, and who thus, by the abolition of the traffic in slaves, made Denmark a shining example to all the nations of Europe; and when she has exhibited to posterity the number of schemes for justice and true civic freedom that this king has brought to light, she will not forget to mention his peculiar interest in the national schools; the important and comprehensive improvement which he introduced in the education of the army; the new and progressively improved form which the learned schools owe to him; the important extensions and reforms which our university has received; and the various plans, not only for the arts, but for the sciences, whose existence or increased life and vigour are owing to the same beneficent hand. That which history will one day relate of your majesty, is gratefully felt by our hearts to-day. The Institution whose foundation we are now celebrating, adds to our feelings of gratitude, and inspires us with fresh resolutions to contribute our assistance to the attainment of the great intention of the father of our country. May heaven bless the king and his family! May our country prosper, and this Institution contribute to that end!

SPEECHES DELIVERED

AT

TWO DIFFERENT

SCANDINAVIAN SCIENTIFIC MEETINGS.

1.—*Speech at the first meeting of the Scandinavian Naturalists at Copenhagen, 3rd July, 1840.*

WE commence to-day with a series of communications and transactions which will be favoured by the good wishes of all Scandinavia. It is not only as an undertaking to benefit natural science that it excites all this sympathy: were this alone considered, there would still be no want of sympathy; but it would not be so strong and so living, and exciting the interest of all the enlightened men of the North. No, indeed, we here see at once a great and significant expression of the northern national spirit, daily developing itself more and more, by which we clearly perceive that we who are sprung from one stem, and speak one language understood by all, (even though it be in various dialects,) and who preserve venerable monuments of antiquity common to us all, have doubtless also great ends to attain in common, have one common position to reach in the world, and by proofs of mutual love and respect, have to maintain one common brotherhood, during a life of prosperity.

At the end of the last century and at the beginning of the present, we already saw a manifestation of this spirit in a Society founded by a Scandinavian philosopher; and since that time it has been continually expressed, partly by the mutual appropriation of mental discoveries, partly by numerous friendly meetings: but nothing ever happened in this direction so great and so comprehensive as the formation of the present Society. The meeting at Gotheborg, for which there was so little preparation, proved at once how much might be expected from it; and we need only survey this numerous assembly, which embraces so many forces, to feel

convinced that our hopes will be fulfilled. I will not mention here the influence it exercises on the success of Natural Science in the north, to which the attention of every one has been already turned, but I shall beg you to side with me upon the influence which science exercises on ordinary northern life, which has been certainly felt by all, but hitherto not sufficiently expressed; and perhaps you will not be disinclined to follow me from this central point, on a more extensive flight, into wider circles.

It is obvious that the advantage derived from meetings like ours, is not alone directly scientific, but that it possesses, perhaps in a still stronger degree, a universally humanizing effect; indeed we may consider this to be its most important function. This was already remarked by the celebrated founder of the first scientific meetings, and has been since acknowledged by men of the soundest judgment. Meantime, particularly in latter years, a different opinion has endeavoured to establish itself, not indeed by means of open opposition, but by all kinds of condemnations and propositions, which proceeded from an opposite view of the case. The public meetings were by some considered nearly superfluous, and it was thought better that we should confine ourselves to sectional meetings, in order that each person might keep to his own particular department. Although the voices who advocated this opinion were worthy of the utmost respect, I nevertheless feel myself summoned in the strongest manner to oppose them. I willingly allow that they were raised from a desire to promote fundamental knowledge, and a self-restraint which is favourable to it; but upon a nearer examination we find that this self-restraint is much exaggerated, and that it circumscribes man's whole mode of comprehension, and more or less excludes from his perception all that lies beyond a self-made narrow horizon, within whose boundaries much besides may have been performed. At all events we ought to convince ourselves, that the public meetings can be as little replaced by the sectional meetings, as these others by them.

It is obvious that in each department there are various subjects which may possess an interest to all labourers in science; and how could a better opportunity be presented to obtain a desirable view over a portion of the progress that has been latterly made, and to pursue the spirit of develop-

ment which governs the whole, than at these larger meetings, where new ideas and discoveries are proclaimed abroad.

By the exclusion of these public meetings, in which we must always be desirous to hear short reviews on many subjects which ought to be treated more circumstantially in the sections, our whole undertaking would lose its unity; and this would not alone be the case, if they were entirely laid aside, which perhaps no one would propose, but even if they were treated as a secondary consideration, only to be retained as a kind of necessary evil.

By the public meetings we also place ourselves in active connection with the whole people. I know that by many this is regarded rather as injurious than beneficial. It is thought that the communications thereby assume a less learned appearance, a less definite scientific form, and we must certainly allow that this does sometimes happen, indeed must occur, although by no means always; but it is another question whether they are right to consider this as a clear irreparable loss. They do not take into account the pleasure which enlightened men who do not belong to any particular department derive, from their participation in them; and the utility it is to ourselves, to have truth represented in new forms, is still less considered. It is true that there is a false striving after popularity, a mere chase in pursuit of pleasure and to produce an effect, which is unworthy of the man of science, and that by such means entertainment is afforded, which, in place of being useful, only confuses and prejudices those who participate in it. It cannot be denied that even a true statement of science may be wrongly comprehended by the uninitiated, and it is certain that he who resolves to raise objections by exposing the blunders of such expounders and recipients of science, would find no difficulty; but neither would it be difficult for him who with equally hostile intentions were to peruse profound discourses, or learned books. However, a conflict of this kind does not lead to a correct determination, which can only be attained by comprehending the thing in its true spirit; and to this I must now call your attention.

By this predilection towards a one-sided conclusion there also arises the complaint expressed by some, that the assembled naturalists have not met with the repose which is necessary, to enable them to spend their time exclusively for the pur-

poses of science, but that they were impeded and disturbed by the feasts which were given them, and by other tokens of hospitality and regard with which they were received. I believe that such complaints were only made on the occasion of one meeting in Germany, at which I was not present; but even if occasionally there have been some failures owing to this, the assertion nevertheless betrayed in its generalizing tone, an over-valuation of the knowledge that is collected, and a want of proper feeling for the universal and humanizing effect in the undertaking. The whole meeting is itself a festival, replete with the highest intellectual enjoyments, naturally combined with others of a lighter kind, which occurs with greater gain than loss, if all is regulated with moderation and with a purpose.

Perhaps it may appear superfluous to spread this misunderstanding, in an assembly where the kindly feelings with which the hospitality of Sweden was last year accepted, and where the scientific activity which was so vividly expressed in the Gotheborg meeting, is still so fresh in our memories; but whenever a false notion is proclaimed with a degree of confidence that might gain adherents to its cause, it is no useless matter to bring forward a contradiction; for although the comprehension of the purpose of such societies, which is founded in their nature, will undoubtedly rise against all attempts to replace them by anything of a one-sided character, yet the approbation which such objections have gained from individuals, more or less disturbs the beautiful harmony which is a fundamental element of the essential character of our society.

But I return to the effects which I think we may venture to expect from our undertaking in Scandinavia. Should it appear to you that I wander too far, I beg you will first consider, that thought naturally leads us to the most extreme boundaries of that which is attainable, and that in order to arrive at anything great and glorious, we must fix our eyes upon the aim it holds before us, although we know that Reality everywhere places great obstacles in our path, which only permits us slowly and imperfectly to approach this aim.

It is evident that the mutual services which naturalists render one another, and by which they are so strongly bound together, must be immensely increased by our meeting; and while science is thereby promoted, friendship also becomes

more cordial and more vigorous, and congenial kindly dispositions will be distributed by means of lectures, speeches, or writings, through extensive spheres of activity, by all who enter into such alliances.

At these meetings people from one country behold the scientific arrangements of another, and discourse about them, now with the most enlightened men of these countries, now with enlightened fellow-countrymen, who see things along with them, and therefore share, with the whole force of a fresh impression, in the criticism and correction of ideas. In every place we shall find something to imitate, and when nations receive good from one another, everybody gains, and mutual respect and kindness is increased.

One nation also hears the tongue of the other spoken, not merely in daily language, where it is often carelessly treated, but in carefully studied lectures; and when they do hear the language of every-day life, it is in its noblest form, in the more enlightened circles of society. In all this we may constantly learn something from one another. This is even the case in the pronunciation; for without any unreasonable attempt at amalgamation, we might with equal advantages smooth the path towards it, if guided by the example of others, we laid aside those inexactitudes in language which have not hitherto taken root; and if, wherever custom was wavering, we endeavoured to agree upon that mode of pronunciation which appears best adapted to the common character and law of development of the northern languages.

We shall also derive this benefit from our meetings, that we shall gradually abstain from censuring certain expressions employed by our neighbours, which is such a frequent practice between nations whose languages are nearly allied; and often, where a very ridiculous or disagreeable association of ideas is awakened in the people, by some particular word in use among their neighbours, we might ward off the offence, by abstaining from its employment in written language.

The improvements which may be introduced into our language are still more extensive, if one nation were to adopt some of the words belonging to the other. Sprung from one root, the one may in many cases be easily and properly enriched from the other. A successful commencement has already been made during the last half century. The Danish language has adopted several happy expressions from the

Swedish. In spite of my diligent study of Swedish literature, I do not trust myself to say with certainty, whether something similar has not occurred on the part of Sweden; but I imagine that it is so. Among a variety of means which may promote this mutual enrichment of our languages, our present meeting will also hold a place, and by no means an insignificant one; for language is of essential use in the powerful development of natural science.

The importance which must be attributed to our undertaking appears still more forcibly, when we turn our looks inwardly. The manner in which natural science searches for reason which is revealed in nature, namely, by investigating, collecting, arranging, and weighing all that is offered by experience, has this important advantage, that we earlier arrive at an agreement in this than in any other science, except mathematics; for no sooner have we discovered a new condition of nature, or have corrected a former mode of comprehension, than it immediately gains acceptance, not always without opposition, but seldom with one more obstinate than is requisite for an impartial examination of the truth. Misapprehension cannot easily endure long where the subject under consideration can be represented in its sensible existence; and self-love, by which men are often led to the most obstinate assertions of previously adopted opinions, has not here such strong temptations to resist, where men are not so often conquered by the superior power of another mind, as by the sentence of nature herself. Therefore, also, in all communications between naturalists, the feeling is evident that we do not merely communicate something of our own, but something which is discovered in nature; thus, however great the merit of the discovery, it does not come forward so strongly as in most other sciences. But if there is a greater amount of repose in the natural sciences in comparison with most others, it is yet no sign of a listless quiet. If we have fewer struggles with one another, we have greater need to struggle with the obscurity which conceals from us the revelation of reason, in the infinite variety of the physical world. Our ancestors have left us many weapons for this purpose. Each new discoverer teaches again something new to his fellow-combatants. There is, therefore, a constant progress, a constant development in the natural sciences, and we may say, a constant fermentation; in short, a mighty

activity of life, in which the destructive forces are not allowed to prevail, but are rapidly compelled to become constituent parts of new creations.

With this inner life Natural Science approaches a great future. The influence it has hitherto exercised in human affairs, however powerful, is trifling in comparison with that which is still to be developed. I will not here speak of the great expectations which are cherished by every one, of the continued improvement that Natural Science must shortly produce, in all the arts of peace and war—I share these expectations, even with the most sanguine—but their influence upon general intellectual improvement alone claims our attention here. The numerous discoveries which conduce to the business of life, are not unprofitable in this respect. Many who formerly lived constantly under the stupifying yoke of habit, are roused by each of these discoveries to the necessity of thinking, and many others are also awakened to a more powerful activity of their minds, by their endeavour to discover something new. We easily perceive how extraordinarily extensive and prevalent this mental animation may become; but Natural Science itself, regarded as a means of intellectual improvement, claims a far greater and wider influence than it has hitherto exercised. It is not yet included in the usual course of education; at least not in that of our northern countries. I know that many are of opinion that this want may be repaired in a riper age; to which I reply that this may be done in the same manner as in other branches of education, but by no means more easily. With the exceptions which are always made for men of remarkable talent, learning does not properly combine with our natures, unless we have laid a foundation for it in childhood. So long as people talked of introducing the natural sciences into education merely because they saw that they contained a tolerable amount of acquirements, they repelled the most intelligent instructors, and with justice, for education ought to be intellectual improvement. But it is not difficult to convince ourselves that there are talents in the child which cannot be fully developed, without the assistance of Natural Science. These talents proceed from a natural apprehension in the senses; they are developed in the most various ways in daily life, though without arriving at that unity or that intensity which Natural Science can bestow on them. But since

education, by the greater requirements of later centuries, must unavoidably be very artificial, the soul is prevented from freely yielding itself to nature; it must now be again led back by artificial means, and this only takes place through Natural Science.

As a branch of education, it has this higher aim to reach, to mingle the sensational with the rational comprehension, and so to succeed, that we may comprehend things as if Reason herself perceived them. I know that to attain this in perfection is impossible upon earth; but to endeavour to attain it—to enjoy a glimpse of this intellectual life—is possible, and to that point the future education of posterity should more and more incline. It will not be easy to bring the methods of school instruction in the natural sciences to the same perfection as we have brought them for languages, and other older-established portions of education. But, nevertheless, we shall succeed, if we are only first generally sensible of their importance.

I believe that if Natural Science were thus to constitute a large portion of general education, it would be followed in a far stronger degree by that effect which it has already begun to exercise during several centuries; namely, by opposing that tendency towards subtilty and artifice, which is promoted in proportion to the one-sided development of other talents. Of course, I by no means say that other sciences should be neglected; on the contrary, I think that the development of Natural Science would be also defective, if it were not intimately united with the others. Of this I am convinced, that the energetic, present reality, the practical spirit, and, I may add, the powerful, onward-striving, yet glorious repose, which may be promoted by natural science, ought to form part of our existence. When this comes to pass, natural science will exercise a totally different and a greater influence upon literature and cultivated life than it has hitherto done; and the co-operation of the naturalist in this future will also obtain a much greater influence than that which we have been hitherto inclined to grant it.

It is therefore evident to me, that the just view concerning the advantage that would ensue from the greatest possible unity of Scandinavian literature, which has arisen from the enlightenment of the times, has been greatly strengthened and extended by our Society. I repeat that I do not aim at an

amalgamation. Each of the Scandinavian nations will naturally form its own literature and its own character; but by means of a well-considered co-operation the literature of Scandinavia will be distinguished from that of other nations by important peculiarities, so that with a noble self-consciousness we may appear as united Scandinavians to the whole world.

If our literatures, with their valuable treasures, are but little known beyond the north, it is because they are many literatures, and not one; if our language is only understood in some few countries, it is because we allow strangers to believe that the North possesses several languages; because we do not represent the thing as it really is, namely, that we possess one common language, formed by our literature into two dialects. By a mistaken national pride, we have separated ourselves, and caused strangers to undervalue the productions of our minds. Let us unite together; let six millions of Scandinavians place their power in one scale, it will certainly not be found wanting.

But the same spirit which does not allow us to be only Danes, Swedes, or Norwegians, but requires that we should likewise feel our unity as Scandinavians, does not again permit us to be merely Scandinavians, but requires that we should feel ourselves members of the great confederation of all enlightened nations. Our meetings should not serve to isolate us from this, but to participate in it more independently, and with greater vigour. The scientific meetings of each nation may, in an European sense, be regarded as provincial meetings, but they must be again united. This may be effected by several among us frequently attending foreign meetings, even without any definite arrangement being made for the purpose; but it would be beneficial if such a union could be secured by the co-operation of the state. I therefore consider it desirable, that the Government, which has already honourably supported these meetings, should contribute to this end by pecuniary assistance, whether it were agreed that it should select those persons who are to be assisted on their journey, or whether it would not be better to allow them to be chosen by the scientific association to which they belong.

It might perhaps conduce to a more comprehensive unity, if, every fifth year, persons selected from different countries, assembled at a still greater meeting: the elections for this

purpose might be determined by the associations of the different countries.

I will venture upon one more proposal for the improvement of our Scandinavian meeting, in hopes that its members will examine it more closely, and thus bring it to a greater maturity, or that they will enlighten us upon its defects. I believe, namely, that it would be very useful, if our Scandinavian Naturalist Association were to choose a committee for each division of the country, who, in the interval of the meetings might secure our interests. This might be called the Senate of the Scandinavian Naturalists and Physicians, and would be in some measure to us what the "Council" is to the great English societies. The members might be chosen every two years.

I conclude my address by welcoming our guests, who are fraternally united with us, and with the desire that the hope which we entertain of a harmonious and vigorous co-operation in our great purpose, may be confirmed by an abundant and productive fulfilment.

2.—Speech at the Opening of the Fifth Meeting of the Scandinavian Naturalists.

It is with the utmost delight that I fulfil the honourable duty imposed on me, to welcome the Fifth Meeting of the Scandinavian Naturalists within these walls, where we retain such a lively and happy recollection of a former Meeting. I had also the honour to open that Meeting, and to express the thoughts and the sentiments which I believe prevailed among every one present. However much I may have failed in the manner I executed this duty, I had the great satisfaction to know that it was not considered that I had mistaken those sentiments. We were animated by the same spirit as that with which we commenced our work, and which has ruled it ever since. Our principal aim was to contribute to the successful growth of Natural Science in the North; but as northern naturalists, we necessarily and gladly united another end, namely, to labour for a fraternal spirit in the North. We were desirous and were compelled to keep within those bounds which were set before us by our own principal aim, and to leave to each individual member what he chose to attempt for the same object, which lay out of our own sphere

of action. It will perhaps be found that these bounds are not so narrow as they might at first sight appear, but, at any rate, they have this important advantage, that they exclude every addition which might offer any occasion for dispute.

The development of language is not the least of the endeavours by which our Association can produce a fraternal spirit in the North.

I have ventured to touch on this subject, both in our meetings at Gotheborg and in the last meeting at Copenhagen; but however frequently it may be treated, it is still never exhausted. It was my intention, as far as lay in my power, to call forth reflections which might serve to make our efforts in the cause of Natural Science as useful as possible to our common language. I call it common, with the same right, by which all the dialects which were spoken in ancient Hellas were called Greek. There is undoubtedly the most perfect agreement amongst us, that our language is common to us all; but that is not sufficient, this recognition must be constantly kept alive. That the mental efforts of the North may have a really great appearance beyond our own boundaries, and that they may be worthy of the North, we must stand forth as one community. We can imagine in what light the spirit of Germany would be exhibited, if the love of home was carried to such a length in every German state, that its inhabitants only desired to bear its own particular name; if the Brandenburger, the Hessian, the Saxon, the Würtemberger, &c. &c. would no longer be called Germans, but each be denominated according to the state to which he belonged, and if each maintained that he wrote the language of Brandenburg, of Hesse, of Saxony, or of Würtemberg, and thus in all the other States of Germany. Without descending to the smallest States, we might easily obtain a dozen names, but the distinction of names would have led to a real distinction. Each of these divisions would have endeavoured to bring forward its own peculiarities of dialect, and particularly those which deviated in the greatest degree from the rest. Thus, in the course of time, a separation would have been brought about, which, if it did not entirely obscure, would yet have disturbed, in a perplexing manner, the glorious name of Germany. Luther, Copernicus, Albert Durer, Opitz, Kepler, Stahl, Leibnitz, Winkelmann, Lessing, Goethe, Schiller, Mozart, Kant, Bessel, would not

then have become names which constitute the ornament of a great nation.

It is true that the North is already divided between two dialects, which are distinguished by numerous works of talent; and that it is not possible, perhaps not desirable, that they should be amalgamated into one; but the reciprocal intercourse which subsists between brother-nations, and familiarity with their mutual works, will gradually draw them together, and thus both literatures will be accessible to any one who is sufficiently acquainted with one of the two dialects, which we may justly call languages, so far as they have each of them attained a high cultivation. In two of the kingdoms we have a perfect unity of language. Let us preserve this! It certainly tends to our own well-understood common good, whereas the intellectual gifts and knowledge which are occasionally employed in an opposite direction decidedly produce general harm. This warning against every endeavour which aims at separating the languages, is naturally accompanied by no prohibition against the improvement which each of the neighbouring nations may bestow on its language by its own independent development: but the aim must be improvement, not separation, and the fraternal spirit must be its protection. This is not fundamentally different from what has happened up to the present time. The language which is written in Denmark and Norway is formed by the common works of their citizens, and so it must also remain.

We shall then, besides, derive the advantage that one nation will be able to appropriate the discoveries, and the acquisitions which belong to the language of the other. There are many natural objects in Norway which do not appear in Denmark; how willingly would we not adopt the words used to designate them! indeed how often have we not done so! Our Danish language may in the same way borrow from the Swedish, but in doing so we must make a few alterations with respect to the peculiarities of the two dialects. But such appropriations are not alone confined to natural objects. There exists in each of the three neighbouring nations an independently-active spirit by which new effects and new mental creations are produced, and which must find means of expression in the different languages; but this should not separate us from one another; for the spirit of the North dwells in the combined languages of the three neighbouring nations. The more we properly

understand ourselves, the nearer we shall approach one another; and yet this approach will not prevent each from retaining his own essential nature. But this must be maintained in love, and with a brotherly feeling.

I have been obliged to quit my particular subject for some moments, though only to make such preparations for it, that its importance may appear in a stronger light, and that many misunderstandings may be removed, to which I was exposed, when those exaggerations were ascribed to me, which are so often united with the endeavour which I advocate so warmly.

On a hasty glance it appears as if the development of Natural Science was not intimately connected with that of languages. The greatest part of science is replete with foreign words, which cannot be replaced by native ones without subjecting ourselves to an effort which would bring with it but small reward, and would also cause the most extreme confusion. It is true that there is a great deal in science which would lose its European utility, if it were too much clothed in the peculiar language of each nation. It would be blindness to deny this; but on the other hand, we should fall into a still greater and more injurious error if we did not recognise the national view of Natural Science, and its claims in consequence, to a national treatment, and to a national development of language.

Whilst a mass of knowledge is undoubtedly exhibited in the numerous details of Natural Science, which must always remain inaccessible to the multitude, even to the multitude of educated people, which knowledge is expressed in words, everywhere understood by scientific men, there is also a part of science which ought to become universal property. Some of the subjects belonging to this class have already received a name for ordinary life; but as science progresses it will be necessary to invent new terms, and to disinter many old expressions. Those parts of science which are generally popular, and which form such a large proportion of that which is able to be communicated, most particularly require that the expressions should be borrowed out of the language itself; for language contains a hidden philosophy which secretly animates the words so far as they are formed by the strength of their own essence. We must beware of adopting the translations of foreign words, unless the trans-

lated expression is so constituted that we should have been willing to form it ourselves, even if the foreign model had not been before our eyes. We must almost as much beware of forming words which express too much, and become a sort of definition. Such words are frequently hard, and still more frequently unmeaning, that is to say, unfit to denote all the distinctions which the development of the idea requires. Finally, it is very important to avoid those words which are difficult to pronounce, and which generally have an unpleasant sound. Natural Science frequently places us in a position where we are obliged, like the first man, to give a name to a thing with whose existence we were previously unacquainted. We are naturally unable to make use of the original freedom of man, or even of that great freedom which is employed in the formation of systematic names in Natural History and in Chemistry, but we must content ourselves with drawing our expressions from the means which our language presents to us. All that we are authorised to do is, to employ them with a true mental freedom. Before any one attempts to form an expression for a scientific idea, he must first be complete master of the idea, and see the thing clearly before his eyes, as if he were going to discourse about it to an assembly of his distinguished fellow-countrymen. He must also, so to speak, search the language to discover whether it already contains a word which is fit to denote the idea, or whether perhaps certain laws of language, or only intimations of such, may serve him as a guide. The more an expression directly and from the commencement speaks to the natural sense of the language, we may according to rule be the more certain that we have hit upon the right expression, and that we have placed our ideas in connexion with the rest of the knowledge of the people. But we cannot form such words and expressions with the rapidity which may be employed in the construction of systematic names, which are formed according to certain rules: no; here every suitable new expression is either a fortunate discovery or a welcome invention. These are collected together in the course of time by the united efforts of many. The co-operators in this work must not be discouraged if many words do not afterwards prove suitable; they must learn to know, that the less happy expressions may in the course of time harmlessly pass away; but they are entitled to expect from the justice of their fellow-

citizens, that the good which has been attained will not be forgotten amidst their less fortunate efforts. Meetings such as the present appear to me peculiarly adapted for such considerations, and I am not without hope that we may accomplish something to this purpose in the present association.

I might perhaps be so fortunate as to find that you approve of all that I have said, but that you still regard the influence which Natural Science exercises upon languages as slight. It is of no small importance to prove, that the extent of its influence is very great and significant.

Every one who contemplates the history of science will see what a great influence it has already had upon language, although it at first received but slowly and step by step a popular representation, and although hitherto it has reached but a small part of the extent to which it is destined in time to attain. How many names of scientific objects which were formerly only known to a few, it has conveyed to the minds of all educated people, and how many others it has itself constructed, and by that means given us expressions which may be also employed beyond the limits of actual Natural Science! We must also recollect that it is very little more than two centuries since attempts were seriously made, though they were at first but feeble, to express scientific things in popular language, independent of the primitive Roman tongue.

When the great astronomer Kepler in the year 1616 published a German extract from Archimedes, he found it necessary to give Latin translations of the German technical terms then in use, in order that those who had been hitherto accustomed to the Latin should understand it easier. Among these we meet with "Kraiss,—circularis linea;" "Umskraiss,—circumferentia;" "Bogen,—arcus;" "Winkel,—angulus;" and several still more familiar words,* which were certainly not new, but now appeared with that precision which must peculiarly belong to technical words. They became much more extensively used as they were employed on innumerable occasions, where formerly only Latin words were admitted. It will be at once understood how much the use of German words enabled thousands to gain admittance to the fundamental truths of mathematics, to whom the Latin words of the science always remain somewhat strange. If we were only treating

* I have borrowed this example from Carl von Raumer's "Versuch einer A.B.C.—Buchs der Crystallkunde." (Berlin, 1820.)

about a few technical words, for instance, only about terms used in mathematics, it would not be a thing of any great importance, but we speak here of a universal law for the communication of science. I am aware that those philosophers who have not been engaged in popular communications, attribute very little importance to this transference of technical words into the mother-tongue; but the importance is sufficiently decisive to those who have themselves attempted popular communication. But we do not here speak of technical words alone. This effort to introduce popular technical words is only part of a comprehensive endeavour to introduce popular modes of expression and popular representations. I do not here refer to that endeavour towards a universal comprehensibility, which often leads to a discursive treatment of the subject, but only to such as, without sacrificing brevity and precision, attains its popularity alone through the simplicity, the aspect, and if I may so say, the naturalization of its expression. Even men of great learning in those departments where no communication occurs, and whose knowledge of languages gives them the key to foreign technical words, will find that by means of that kind of popular communication we have here mentioned, they will arrive at a far more lively, and at the same time a more direct comprehension of the subject. It will not be useless to illustrate this with a few examples. It is sufficiently known what is meant by the words barometer and thermometer, even the origin of these terms is familiar to those who understand Greek, and to many more besides. Nevertheless we frequently hear these words confounded, which does not, however, proceed from ignorance, but because the ideas are not directly or sufficiently attached to the words; if we were to say air-pressure-indicator, heat-indicator, these mistakes would cease. Foreign technical words also frequently lead to an artificial representation of things,* for example, "In order to judge of the weather, we must know the barometrical, thermometrical, and hygrometrical condition of the air, and therefore we must make observations upon the barometer, thermometer, and hygrometer." Whereas if we keep closer to the mother-tongue, we shall say, "In order to judge

* I have not taken these examples from any particular book, but I formed them from expressions used in certain German and Danish works.

of the weather we must know the pressure of the air, and the amount of heat and damp, which may be observed by means of the instruments intended for that purpose."

But it may still be objected that this cannot act very extensively, since Natural Science is not an affair of the people. I confess that hitherto it has been too little so; but the whole course of development of the human race necessarily obliges it to become so more and more. I repeat what I already said at our first meeting in Copenhagen, with regard to this, that there is a great future before Natural Science. Regarded on one side this future already reveals itself in strong features; namely, that the incalculable benefits of natural science impels so many people to work in accordance with its dictates. Undoubtedly most people will do this without any knowledge of science, but they unconsciously gather fragments of it, which distribute many seeds for reflection. Others will strive after the knowledge which lies at the foundation of their labours, and will thence have their minds directed towards science, and among these some will also be induced to cultivate that knowledge with a higher aim in view. But all these aids in its support are not the chief object here. Our attention is particularly turned to the influence which science may possess over general intellectual development, and indeed in consequence of its own nature. Although much has been already said upon this subject, it will still be necessary to recur to it for a long time to come. Man is connected with nature in countless ways. All the organs of his understanding are indeed natural objects, and subject to natural laws. Even most people who have no idea of Natural Science, are aware of many results which science has supplied on the meaning of what we witness by our senses, by the communications which, so to speak, have been transmitted to us from hand to hand; for instance, that the blue vault of heaven is not fixed, that the rainbow is only a phenomenon of light, that the echo is a reverberation of sound, and innumerable other things of the same kind. It is the same with our living bodies. Much knowledge has passed out of Natural Science into daily life, and frequently indeed in a very obscure manner; the more our mental life is developed, we shall feel still further impelled to obtain a clear and connected knowledge concerning it, and the more science is enabled by its progress to satisfy such desires, they will assume a more

animated and determined position ; but this will also happen with respect to all our relations with the outer world. We are incessantly receiving impressions from the weather, and we stand in the most various relations to the climate in which we live. Were we not so much accustomed to the universal ignorance of the laws whence these effects proceed, would it not appear absurd ? But this ignorance begins to be dissipated by a desire for knowledge, which will continue to increase with the development of the mind, as well as by the advancing aids of science, through which our questions may be answered. The same may be applied to our relations with the whole of nature, with a few alterations which may be easily imagined. Every step on earth causes us to perceive a testimony of the past ages of the globe. The clearer the insight we possess by means of which we cultivate the earth by agriculture, so much the more shall we endeavour to understand its condition, and this will be the case in a still higher degree with respect to the natural laws of vegetation. Ought there not to come a time when every enlightened labourer may delight in his knowledge of the inward structure of the seed, and the laws of germination, the laws for the nourishment of plants, their silent respiration, &c. ? In a superficial comprehension of the subject it will be said, and not without an apparent foundation, that what science is able to communicate upon all these things is partly too meagre and partly too learned ; but they forget that we here speak of a future time, and of one indeed which is tolerably distant. It will readily be allowed that in the course of time science will yield a much more perfect knowledge, but I must add that, taken as a whole, its results will be also much more clearly expressed, according to the greater degree of inward perfection which it has reached. In the endeavours which will be made in the course of a long period of time which lies before us, to render science accessible, many new ideas must offer themselves, and along with them also numerous occasions for new expressions. We must remember that we here speak of all that can be comprehended in the heavens or on the earth, which is matter of instruction to mankind in general. Even the science of language will by this means make a new start, and in certain directions gain a previously unknown richness, which will also exercise an influence in many other ways. With all this development before our eyes, I can only desire

that, as true Scandinavian brothers, we may work together for the improvement of our northern language, or if you will, for our several northern languages.

I am rejoiced to leave undisturbed the thought of much that has been already done to remove the impediments for such a future, as well as the steps which we have already begun to make in its advance. How much the dark prejudices, which the mists of ancient times have spread over our north, and which have been cherished and nurtured by aversion and hostility between neighbouring countries, have now vanished before the light of knowledge, which we may hope will never be again obscured. Our Naturalist Associations stood in the foremost rank among the greatest of those public demonstrations, but they were by no means the only ones. We have seen youth with generous enthusiasm wander from one kingdom to the other, only to form acquaintance, friendship, and brotherhood. It is delightful to observe so many pilgrimages for the sake of enlightenment and love, however small they are in proportion to the events of the world, in which the large mass of the people step forward. It may be a great satisfaction to us all, to see the North governed by two enlightened and highly-cultivated sovereigns, who promote this Scandinavian endeavour towards intellectual improvement. This feeling receives a still greater life and strength by the presence at this our opening Meeting of the noble king of the country, who, if his exalted position did not call him to other duties, would be a distinguished participator in our labours, and who has besides in many ways favoured our undertaking with his enlightened benevolence. I am convinced I speak in the name of all when I here offer him our earnest and respectful thanks.

Therefore, with the most joyful anticipations, I open this our fifth Scandinavian Naturalist Association.

OF THE SCHOOL IN LIFE.

The two following addresses are not indeed of a scientific nature, but they spring from a scientific contemplation of the world, in which religion and morality are both included. No new religion or code of morals is to be derived from them, but they bear the stamp of the spirit in which they were written. One of the most enlightened and reflecting naturalists of the North thus comprehended them, after reading the first of the two addresses which are now communicated. We only insert these works in the present collection, with the desire to prove more and more how the comprehension of the highest aim of the human mind, which proceeds from a scientific view of the world, not only accords with the convictions which we all possess in common, but may also contribute to throw greater light upon the subject.

I.—*The relation between the Young and Old, with especial reference to Young Men on their first entrance into the World. A Speech delivered on the Anniversary of the Society "for Posterity," the 4th March, 1844.*

I HAVE been much gratified by the honourable invitation which I have received, to address this highly respected circle on the present occasion. I consider it a summons to speak at the meeting of a society whose foundation originated in disinterested love to our fellow creatures and our country, and which owes its steady support to a social spirit which did not expire with the founder, or with the first friends of the institution, and whose present condition is not less prosperous and hopeful than in the period of its vigorous youth. Its greatest achievement, the schools whence so many active and in part highly meritorious men have proceeded, continue to labour for youth, with undiminished, we may indeed say with increasing effect, and thence to sow seeds which will germinate and branch out into an unseen future. We ought never to lose an opportunity of bestowing praise on the silent conquests which are made in the service of mankind, by sowing the seed of knowledge, and by the encouragement of intellectual improvement; as these are outshone in the daily

course of things, by the glare surrounding many other undertakings which are often far less beneficial.

In connection with these sentiments, I am naturally desirous that, by my present address, I may be able to contribute my small portion to the object of the society. I have therefore chosen a subject for my discourse to which I have been long attached. It has grieved me much latterly to observe how frequently the relative position of the young and old has been comprehended with opposite prejudice, which, not permitting the conciliating truth to be constantly and openly displayed, has therefore prevented it from being developed as strongly as it ought to be, though it has often silently asserted its practical validity. I have viewed this relative position with the same eye as the natural philosopher views nature. He first endeavours to discover the law by which all things are governed, and afterwards more readily distinguishes the meaning of each individual law. In the same manner, we are able in our investigations to turn our attention to the law of existence, by which the life and action of the rational being is governed, and by that means we most clearly perceive the rights of each individual portion.

The extent of the subject, the narrow limits of a speech, and even the purpose of the present meeting, must determine me to confine my task to the relation which exists between those of our own sex, and especially between those who belong to an earlier, and those of a more advanced stage of life.

I request the patience of my fellow-citizens, and the attention of my young friends; for even if I bring forward many things which are not specially intended to apply to them, we shall yet mention some which are nearly connected with their own welfare; and with reference to those of a riper age, I hope that the chief substance of my address may be sufficiently clear to them.

There have been many wise proverbs and maxims on the relation between the young and old, which have been for the most part known since the most ancient times, and which circulate from mouth to mouth, without however, exercising a proper influence on human life; indeed, the full truth of their meaning is only first clearly understood when the proper time for their application is past. A thorough exami-

nation of this remark, whose influence extends far beyond the range of thought within which we will at present keep, would lead me beyond the limits of my address; I can here only call attention to the fact, that those proverbs are usually proffered in the *form* alone of experiences. This contributes much to weaken their effect. They have not actually been experienced, and therefore fail in the sensibly restraining power which they otherwise possess. To those who have not themselves mentally comprehended and examined the experiences from which these maxims are taken, they exist as empty abstractions, and are treated with indifference as trivialities. Added to this, those who have appealed to these maxims have been frequently led to their adoption, merely by an indistinct variety of impressions, so that they are not aware of the true meaning of the proverb that is cited, and consequently cannot properly apply it. All these misapprehensions may be of course remedied, if the matter is placed in the light of reason. This may be done, and has happened in various ways; but I have selected one method which, as far as I know, has not hitherto been tried, and which seems to me capable of placing my object in the most intimate connection with life itself.

In all that occurs, for which we can trace a general purpose and a rule, we say, in other words, that it obeys a law. That an unsupported body falls, that the seasons continually succeed one another in the same order, that our blood is in constant circulation, are all examples of such laws; which have besides been better developed and determined, by Natural Science. But the same fixed laws prevail, not alone in mere material nature, but also wherever the spiritual is expressed, although they are often concealed, because the effects which take place in conformity to very different laws, here cross each other far more frequently than in material nature; but it is easy to find a considerable number of examples even here, which in spite of those causes are sufficiently evident; for instance, that light rejoices, that darkness terrifies, that uniformity fatigues, that arrogance excites enemies. Further, the whole of existence, and not merely portions of it, is governed by laws, and these again are not a mere collection of laws, but one whole, in which one part cannot be considered without the other. They are, finally, not to be considered as the work of a blind irrational necessity, which

is in itself a chimera, but they constitute one whole all-embracing and penetrating dominion of Reason, in which even the abuse (that is, the unreasonable employment) of freedom, may awaken powers which cause the effects of evil to serve the ends of Reason.

Viewed in this light, those things which seemed to be only connected with the material world, receive a spiritual signification, and those precepts which appeared arbitrary bear a stamp of reason, without which they would be viewed with dislike by the free spirit. In order to comprehend the impression thus made, we must retain a lively and active contemplation of it in our minds. The mere recognition of it is useless.

Let us now turn our consideration to the different ages of man. Each is designed to make a peculiar progress in the development of the being which it embraces; but, at the same time, it exercises a very important influence on those beings which are in other stages of life.

We all know that the child is not merely appointed to replace the loss which death occasions in the numbers of mankind, or to increase those numbers, but that it is also destined to take part in the advancing development of the human race. I may pass very briefly over such well-known things; I might indeed omit them entirely, if I did not wish this very hour to recall them vividly to our contemplation. We should be astonished at the rapid development of the child, both physically and mentally, if habit had not familiarised us to it. But yet this does not prevent the liveliest interest being awakened in those who daily watch the child. It has been often, and truly, remarked, that at the earliest age, it learns proportionately more than in any period of equal duration in after-life; and even at a more advanced period of childhood great progress is made, if proper nourishment is afforded to the mind. Actual childhood, which naturally does not last equally long with all children, has clearly its own peculiar method and mode of development, only to a certain degree dissimilar in all. If anything is neglected at this period, it is more difficult to be retrieved than it would have been to acquire it at the proper time; and if the natural measure of capacity is overstepped in any one direction—for instance, if the child is given too much instruction—the true and healthy equilibrium is often lost during the whole of life.

Childhood, thus, has its peculiar scheme of development, which can neither be perfectly replaced at another period of life, nor can it be usefully anticipated. It is true that the extent within which all this holds good is limited, and that we may sometimes successfully recover what at an earlier period was neglected. But this does not prevent us from recognising the natural law, although an exception may indeed be made for those endowed with unusual powers of mind.

We might be easily led to think that the child only lives for its own development; but we need only consider the matter somewhat more closely, to discover that, unconsciously, it bestows much, while apparently it only receives. Every one knows that the pleasure which men derive from children, is not confined to the parents, but is shared by all around. This pleasure embraces elevating impressions, which, though they are seldom accounted for, are nevertheless received. The picture of innocence which we behold in the child, is not without its influence on us. The feeling of a disposition and an inclination to kindly actions, which is awakened within us by the sight of a child, and which is connected with a sensation of power, though apart from pride and haughtiness; the feeling of love which is thence aroused within us; all this is not lost on ourselves, though we do not express it in books. The parents, silently and unnoticed, become teachers, in endeavouring to assist the child in its powers of comprehension and thirst for knowledge; and thoughts previously slumbering are frequently roused within them. As the child advances, new tasks are imposed on the grown-up man, which are not without their use to him; for he must indeed be more attentive to his own improvement, if he does not wish to be inwardly ashamed of himself before the child. But this shame does not arise from vanity,—it is not produced by the child; it is allied to that modesty which we could imagine a man would feel, were he conscious that an angel stood beside him.

So closely is the life of the child connected with the development of the grown-up man. And yet all that I have been able to say upon this subject is far from exhausting it.

I cannot, however, quit the youthful period in the life of man without mentioning that the love which springs from the reciprocal influence between the child and those of a riper age

surrounding it, is itself a law of existence, whose connection with the nature of things we have now partly beheld, and which exercises a wide and comprehensive influence on the life of society in general. It need scarcely be mentioned, that all this exists even in greater force in the love between parents and children. We now pass from the period of actual childhood, to that which exists between it and youthful manhood.

There is, of course, here also, a certain education best adapted to this stage of life. I may be very brief on this point. It is that kind of education which is afforded by the best schools, and which is chiefly determined by the nature of the thing, to which also must be added the stage of development of that particular time; but we must also acknowledge that the condition of our schools may still deviate much from what they ought to be if they followed the path of nature; which deviations either may and must be removed at no short distance of time, or at any rate must be cleared away at a somewhat further stage of development. Nevertheless, when the youth begins to look beyond the limits of the school, he feels an ardent desire to be able to step at once into the rank of young men of a riper age, and in order that he may share their freedom, he gladly chooses their labours. This desire may sometimes proceed from a good motive, but it is often merely an unseasonable wish to free himself from a useful restraint, and it is then to be lamented if the parents or guardians yield to it. My situation in life has given me an opportunity to gather experiences with regard to this, which are in perfect accordance with what we have already learned from the reflection and experience of many centuries; for instance, that at a certain age the bodily labour which a young man is usually subject to, cannot be undertaken beneficially, but that it rather injures the health, and along with it the physical development; and this is also the case with mental labour. The studies which are assigned to the youth at the age when he leaves the more advanced schools, do not merely require preparation, but also a certain maturity of the powers of the mind, without which the more independent manner of studying does not lead to the object in view. Many young men who can make considerable progress in various and difficult sciences, by the aid of the daily assistance which the schools

afford, will advance but lamely and insecurely in the very same branches, if they study under those conditions which are offered by the university.

In our consideration of the reciprocal influence between the boy and the adult, we will for the sake of brevity especially notice the relation between father and son. The former has to overcome fresh difficulties during the transition of the child to the age of boyhood ; but he at the same time enters on a new and higher sphere of action. Along with the understanding of the boy a force of will is developed which may lead to evil or to good ; he must be guided, even sometimes compelled, to submit to reason, but yet in such a manner that the elasticity of his mind be not weakened. The amiable feelings on which severity is founded, are often imperceptible to the son who submits with inward dislike to the paternal power. The instruction which the son must now receive is more varied and of a superior order. Even if the father is able to commit part of his anxiety to a school, there still remains no small proportion of guardianship and responsibility in his own hands. But the father is not alone led to reflection and anxiety by affection for his son ; much self-denial and many powerful exertions are also required of him. By this means his mind rises to a higher degree of maturity, and the dignity of a parent becomes to him more than an empty name.

He is thus self-rewarded. But how infinitely more the son himself gains by this conduct, without especially noticing the affection whence it proceeds. It is a beneficial thing for him if he recognises it at the proper time.

The relation between the tutor and the pupil is allied to the relation between father and son. If the teacher is not a mere hireling, he will be inspired both with a love for his profession, as well as for him whom he instructs, and thus he will entertain only fatherly feelings to his pupil ; on the other hand, a child-like love will be developed in the youth, which will be the more vividly excited, the more he is a true disciple of his teacher.

In order not to render my address too extensive, I have been forced to confine it within such narrow limits that maternal love could find no place. I have thus omitted a great deal that would have promoted the end I have in view ; but my young auditors will nowhere find it so easy to supply

the gap as here, where the constant recurrence of maternal love and care, in the numerous benefits which are obvious even at the moment of acceptance, will always be vividly remembered by the young; whereas the father, more frequently restraining, commanding, and chastening, is in fact compelled to express himself in actions where the kindly feelings which prompted them lie more deeply concealed. Yet the force and the determination of the father sometimes make a greater impression on the son. This is not a bad sign; but let him at the same time remember the gratitude and reverence which he owes to the infinite love and care of the mother's heart.

We now turn our attention to the period of youth. Its earlier portion commences in the more advanced schools, and therefore has already been considered; but the independent life of a young man after he has quitted school, which I call in a more limited sense the period of youth, has a new signification. There generally lies between school and this young man's life a period of study for those who do not complete all the instruction offered by the more advanced schools, which in spite of important differences, is a kind of protracted school. Of this, however, I do not mean to treat here. The period of youth which we are now considering has naturally its determined limits. It ought freely to develop the character till it has reached the maturity of manhood. The physical powers, the faculty of the judgment, the experience of the world, here make giant strides, if a proper regulation is maintained. Next follows the slower development of manhood. The bloom of youth and the maturity of manhood are similes which have been often used, and they really accord with nature; we must not, however, forget that here, also, the limits are not sharply defined, but that they admit of various transitions.

In other words, youth is the nearest preparation for that period of life which is the longest in duration, and which at the same time influences most deeply the condition of human society. The self-development which the youth has to accomplish at that age is already pointed out for him by human society, in accordance with that which is prompted by reflection and experience, although in every century it naturally receives farther improvement. There also exists at this age a strong, natural, onward-striving, which often degenerates

into a desire to meddle with that which belongs to the succeeding stage of life, and a wish to exercise an important influence on society or science ; but, if we make some exceptions in favour of a few extraordinary men, this is opposed to the nature of things, and therefore brings along with it its own punishment. Many of my young auditors are now approaching the age of which we are at present treating. Resist the insidious seductions which would tempt you to sacrifice your youth to the occupations of manhood ! You thence overleap a period of life rich in joys, and still richer in seeds for a more important future. Be persuaded that he only who has been a genuine youth, in the actual sense of the word, will afterwards become a genuine, many-sided, and well-cultivated man, and at the conclusion of his path be a truly wise old man. But I do not wish that you should accept this from my words alone ; I challenge you to inquire with me into the case itself, and to examine whether I represent it to you in a false light. The law of existence, towards which I would direct your attention, rests on what we have already said. Every period of life has its essential signification in the life of man ; something peculiar happens in each to further the development of mankind, and that which is contributed by one age cannot be perfectly supplied by any other. Hence he who admits the justice of this law, believes at once in a regulated order in life. But a truth is not always accepted with that vivid appropriation which determines our actions. This only happens when the thought coincides with the mental perception. I therefore invite you to take part with me in an ideal experiment. Let us imagine a young man, in the transition between school and the independent period of youth, in such a position that he feels himself called upon to support an otherwise helpless family—for instance, young orphan brothers and sisters ; let us also suppose that he possesses sufficient abilities to acquire all that is necessary for himself, and the proper consideration to procure superintendence, education, and instruction for these brothers and sisters. Will he then have an opportunity to improve himself in the same way as other young men who have no such duties to perform ? He certainly will not stand still during this period : in a very short time he will reach the maturity of manhood, and he will find a great reward in the affectionate gratitude of his brothers and sisters, in the respect of his fellow-citizens,

and above all, in the testimony of his own conscience. Who would estimate these rewards lightly? They may balance the loss, they may even far outweigh it; but there has been a loss and a severe one. I will not speak of the obstacles which the youth may have to overcome in order to attain a certain degree of success. I will even suppose that some turn of fortune fully repaired this want; he will still lose the peculiar development which always accompanies youth. Cheerful and free from care, the period of youth, if not abused, develops an inward health and strength which does not flourish in unfavourable conditions. The youth in ordinary circumstances vastly enlarges his store of knowledge, and, what is of still more importance, he forms his world of thought with an independence which, at an earlier period, during the immaturity of his faculties, was denied to him, and which in manhood he never again possesses in such freedom, even should he be in possession of an independent fortune; for at a certain point in the development of his faculties, he makes other demands on himself, and enters into greater intercourse with the world, so that he must learn and practise totally different things. If such a one, contrasted with him who too early becomes a man, were only to have a moderate degree of the manly faculties developed, he may probably, unless compelled by external circumstances, remain longer a youth; but this is far from being an advantage, and is only a want of participation in a higher stage of development. The imagination and the world of thought in the youth are gradually developed beyond the healthy barriers within which intercourse with the world would confine them; he acquires an over-refinement in certain thoughts and feelings—a certain false and hollow cultivation which is neither adapted to youth or manhood, nor indeed to any age. In every highly-cultivated period of time there is a tendency towards this perversion; and the present is far from being exempt from it.

I dwelt above, for some time, on the loss which the young man sustains who nobly sacrifices his youth at the command of duty. We all felt that he also received a great compensation for a great loss; but, on the other hand, imagine a youth who, with thoughtless confidence in his own talents, was desirous to interfere with the management of the state. What compensation does he receive for having overleapt the most important age of preparation? He must not allow himself to

be misled, by a deceptive imagination, to suppose that the power of doing something great for mankind is immediately within his grasp. It is unnecessary to overleap the short period of youth. While he is making his preparation, the world does not pass so rapidly that he will lose the opportunity of performing a great action, if he has the requisite ability. To be perfectly free, the young man must revel in the great kingdom of thought and imagination; there is a struggle there, in which, if he falls, it is easy for him to rise again; there is freedom of utterance there, which draws after it no irreparable consequences on society, and therefore imposes neither that inward nor outward responsibility which disturbs the soul and enfeebles its cheerful elasticity. It is with pleasure that I recur to that happy existence, when I lived in this onward-striving contest, where each day overcame a new difficulty, gained a new truth, or banished a previous error. That I had not yet entered into the business of the state, threw no cloud over this world of light. It did not occur to me to doubt that an efficient cultivation of my faculties would certainly afterwards obtain for me a suitable place in society. The history of my youth is not essentially different from that of many others who have had the happiness not to deviate from the path appointed to them by nature. I merely relate my own experience because it is mine, and on that account is the most visibly certain to myself; but I know that you may see it confirmed by many other examples.

However, you scarcely require them; for each of you who already look beyond the barriers of the school, will find that nature and truth testify to this within yourselves.

We must turn towards the reciprocal influence which exists between the youth and his parents. If the father has not lost the confidence of his son, and if the son has no secrets to hide from his father, a friendship is developed between them, which improves and elevates both parties. Of course, this must not happen with the sacrifice of character on either side; but rather with the resignation of one-sided inclinations. If the proper relation is observed, the father is enabled, through the son, to regard the younger portion of the world with increased sympathy; and, on the other hand, the son, by the aid of the father on one side, obtains a view into the world of action, in which he himself is one day to be a useful

co-operator, and on the other obtains a retrospective view of the life of young men in past days, which must enlarge his present contemplation of the world. Confidential intimacy increases with age. The son himself becomes a man and a father; and his children again throw the light of another dawn on the evening of the old man's life.

In accordance with this, we shall gladly confess that all true, kindly intercourse between the old and young, exercises an elevating influence on both sides; for it adorns life, and counteracts the wearying one-sidedness which so entirely exhausts the life of youth.

Do not misunderstand me, and imagine that I would do away with the natural divisions of life. No, the old proverb that like should sort with like, is an actual law of life. It is rather the complete separation which I condemn, in consequence of which, as we often see, young men avoid scientific communications with their elders, and these, in a similar manner, shun all social intercourse with the young. This division is injurious, and is opposed to the true nature of things, which requires a kindly affectionate co-operation; for such is the rational law of life in respect to this relative position. This, however, does not apply to an unconscious nature, but we ourselves are directed to practise and to maintain it with independence. There exist within us faculties and powers, which are designed to obey this independent Reason, which, however, we often exercise without its guidance, and thus disturb the harmony of Reason. How can I name all the inclinations and passions which must here be guided and led in the right direction? Let me only mention one, which is connected with many others—our necessary inclination to maintain our independence. How often does this not degenerate into an unjustifiable mortification at seeing the same impulse in another! How often has either the father's love of ruling, or the son's pride, caused two hearts to be estranged which ought to have been most intimately attached to one another! Still the requisite condition of Reason conspicuously preponderates; partly because we are reasonable beings, though often very limited ones, partly because all existence is an infinite reasonable whole in which the unreasonable destructively works against itself. A perfect and pure existence of Reason is an Ideal, which never can be attained on earth; but let any one regard what

most immediately surrounds him, and he must be very unfortunate, or have a very indistinct vision, if he does not discover in this reality, poor though it be compared to the Ideal, a large sum of kindness, co-operation, and mutual assistance, by which one age is bound to the other. He will then see, that if he contributes to the dominion of the law of Reason, he attaches himself to that which forms the truth of Existence.

While I continue to turn towards that class of my young auditors who in a short period are going to make their entrance into the world, I must yet, before I conclude, draw your attention to the manner in which the elder portion of the world must be judged with regard to their activity in science, society, and amidst mankind. There are many who, from a praiseworthy zeal for the progress of human society, desire a more rapid fulfilment of things than is really possible. They expect all from the fire of youth. It is said, the improvement of the world should begin with youth. This saying is self-evident, if we understand by it that a great portion of the defects we are not now able to remedy will be removed by the young men of the present day, when they have so far advanced towards the stage of manhood as to have gained sufficient influence on the course of affairs; but if it is expected that youths, as such, should govern the events of the world, then it is every way opposed to the natural course of things. Let us consider the true state of the matter. Each period receives from the preceding one, various arrangements and conditions which no longer suit the development which is then attained; and the more rapidly the development advances, so much the more sensibly will this be felt. By the progress peculiar to the period, many things will gradually become obsolete. Some errors may be removed, but there are a great number which, in consequence of the nature of the thing, require several generations to be overcome; indeed, in some cases it is scarcely possible that others should not be added, as the removal of certain errors is apt to create fresh ones. In the inheritance which our predecessors have left behind them, there is much which we must struggle against, and remove; but do not let us dwell on this exclusively, and hence allow our mental vision to be so confused that we yield to that false view of the world which would make us believe that our ancestors were men of limited capacities, without independ-

ence and without power. Let us open our eyes to the immense inheritance of laws, sciences, and regulations, which we have received from them. Our century, as each preceding one, will do no more than leave this inheritance enlarged and improved. The next generation will again be in the same relation to the one which succeeds it, and how really can it be otherwise, so long as the human race is in progress? Only he who closes his eyes to the great reality, and who with mental blindness, desires to be other than a part in the natural arrangement of human society, can be displeased with this view. But you, my young friends, may rejoice that this century offers you a richer inheritance of knowledge and intellectual development than any previous period of time had left to its succeeding one. Along with this, it summons you to far greater labours, which you will have to overcome, now to clear away the refuse of former times, now to co-operate in new creations. Rejoice in the power which you feel unfolded within you, and in the promising time which lies open to you; but do not forget that those who retire from the theatre of the world at your entrance, have struggled and laboured, as you in your turn will have to struggle and labour, and as again, in a period which is short in the history of the world, it will be the task of your descendants. In your judgment of the old, and especially of those who have done much to benefit human society and science, I beg you will always remember that every one of these men have had their appointed mission in this world, and for their fulfilment of this we must thank and honour them. He who in the best years of his life has given a direction to his powers by which something very excellent has been accomplished, afterwards appears to the multitude so much the more superfluous, the more perfectly he has executed his task; should he still possess great and useful faculties, he is in a manner expected, after the completion of his work, to commence a new path. I beg you will also consider, that, except his inner consciousness, there is no fairer possession for a man to gain, than the acknowledgment from his fellow-creatures, of the services which he has done to the world. Never abuse this holy property, though, as may easily happen, you should stand opposed on the field of politics or science, to men of well-earned reputation. Truth does not require the abuse of what is right in order to

obtain the victory. Should any one feel the power within him to produce something extraordinary, let him consider that by the abuse of this property he prepares to commit a robbery on that which he himself is desirous to gain.

As the whole of this address has been given to exhibit the bond of love and reciprocal dependence which binds all ages of human life to one another, it may appear as if I were desirous, on principle, that all struggles in the world were removed. This would be as foolish as to hope for the destruction of all evil in the finite world. I cannot deny the truth which the poet has so happily expressed, that all,

Even to the smallest part,
Changes between Hate and Love.

But the number of false notions which have been entertained concerning the relations between the different periods of human life, and which by a sort of half truth have crept into favour, weaken the bonds of love, and scatter the powers which ought to be united. If the present time were a period of kindliness and love, which, however, tended to pass into an effeminate state of thought, I would then be on the side of those who might desire to introduce a more stirring activity into the repose which threatened stagnation; but this is unnecessary now: we are, at the present moment, obliged to look round amidst a variety of party strifes in life and in science, to judge correctly how we shall maintain peace, that we may be able to fight with undivided powers for the real good.

Let the old remember that they have once been young, and that Youth is the seed of the Future: let the young consider that they themselves will one day be old, and that they will then see a new generation before them. Finally, let all remember that every age, in spite of many differences, is still, in consequence of the eternal law of Existence, bound together by a common bond of love.

2.—*A speech delivered on the reception of Young Students as Academical Citizens.* November 1821.†*

THE illustrious Plato viewed the state as a living being, in which each class of the citizens represented a particular member, so that the whole state appeared as an image of human nature. In the same manner every smaller, yet efficient and well-ordered society, may be represented with deep signification as the image of a living organic being; for has not every one of its members the advantage, that all the others are forced to work for it? and again, is it not also obliged to work for all the others? so that every part is the end as well as the means, as one of the greatest philosophers of the last century so strikingly exemplifies, in the nature of organism. But this organic body owes its life to the spirit and the power of its limbs, and the preservation of this life in undiminished health to the incessant addition of new, sound, and active members. Thus I view with pleasure the annual reception of new citizens into the University, as an annual regeneration or renovation of our upper school, which, though indeed long established, is yet in undiminished youthful vigour; and it seems to me to be an excellent arrangement, that the annual restoration of our society should be united with the remembrance of its former great restoration, in which its religion was purified, and its regulations were improved.

This image of our University does not appear to me empty or barren, but particularly adapted to place before us all the holy bonds which ought to unite the members of this venerable institution.

It affords me the greatest pleasure to imagine the different elevating feelings with which the older or younger men, who are now present, must each be inspired according to his position. The teacher may be reminded, on the present occasion, that he labours at an eternal edifice, and may rejoice in the

* The academical citizen in foreign universities is subject to peculiar laws, and a police appertaining to the university itself, before which he is liable to be brought if he transgresses the laws.—TA.

† By the statutes of the University of Copenhagen, an address of some length is delivered on the day commemorating the establishment of the Reformed Religion, by one of the Professors, after which the Rector addresses himself more particularly, in a short speech, to the students.

thought, that amidst the variety of young men who are to-day received into the bosom of our society, there will be some who are appointed to labour at the farther completion of this glorious edifice. He may reflect that a still greater number will be enabled to distribute science by word and by writing, and thence will lead their fellow-creatures still farther on the path towards wisdom and virtue. He who would not be unworthy of his high vocation, will at least contribute something to introduce the maxims of wisdom into human life ; for the stability and the development of social life is connected by innumerable fine threads, invisible to the unassisted vision, with the learning which springs from the deepest researches, but frequently through so many ramifications that the enquirers alone can trace the commencement. How can the teacher believe that he shall be permitted to assist in consecrating the blooming season of youth to such fair destinies, if he does not at the same time feel inspired with a delight which is closely connected with his zeal for the True and for the Beautiful ? and how can he implant a desire in the young to meet this consecration, if he does not himself feel drawn towards his pupils with feelings of kindness, and if his greatest pleasure does not consist in being of use to them ?

This celebration must be still more memorable to those young men who first receive their academic rights. I will not speak of the becoming cheerfulness which every one of them may feel, when he beholds his industry rewarded by his reception into a new and higher rank of fellowship ; but I can well conceive the thoughts and feelings which may flow through those who are of an earnest disposition. He who is not satisfied with the mere surface of things must perceive that in the transition from the restraint of school to the freedom of the university, he makes a most important step in advance. It is important with respect to his position in life to exchange the restriction of education, with that condition in which he is actually the master of his own actions ; but it is perhaps still more important with respect to his scientific life, to exchange the leading-strings of the school, with that freedom in the choice of his studies which is offered by the University, though not indeed without a judicious mode of transition. In the schools, young men have only to learn and to understand ; at the University, they must accustom themselves to assist in investigation ; and yet our regulations,

without imposing restraint, enjoin them to prepare themselves first, by those studies which most encourage independent thought.* The young man is thus encouraged to extend his acquaintance with the dead languages, but more especially to penetrate their spirit; he will be induced to become more intimately acquainted with that science, without which Plato permitted none to be admitted to his Academy. The entrance into the depths of philosophy is revealed to him: the eternal circulating motion of the Universe is laid open to his eyes; the most simple, and hence the most comprehensive, laws of nature are unveiled before him. In truth, the young man who reflects with indifference that he is to participate in such glorious knowledge, should rather inscribe his name in an ordinary guild than attempt to become a citizen in the kingdom of science; for he will be just as indifferent to those branches of science towards which he afterwards turns, and which are to form the business of his life.

Indifference towards science in him who ought to be its guardian, is generally the greatest proof of his being unworthy to participate in it. He, on the other hand, who feels a real delight in the knowledge he gains, without regard to the advantage and the honours which it may procure him, is justified in believing that he has entered the sanctuary of science, and he will certainly, by continued efforts, penetrate to its sacred depths.

I entreat, my young friends, that you will keep your high vocation in view, and thus continue to nourish the holy flame of enthusiasm. You must never forget that it is our spiritual nature which renders man the image of God, and that it is science which constantly develops this divine spark within us, partly by showing us our own internal being as in a mirror, partly by keeping before our eyes the impression of the Divinity, which is everywhere manifested around us in nature. Let the conviction of our glorious spiritual nature be always present to you, not only in the study and in the lecture-room, but through the whole of life. All that you witness

* The more advanced schools have latterly been so much improved, that they also embrace the Disciplines we here allude to, with the exception of Philosophy; yet many still attend the more comprehensive lectures on Natural Science, which are afforded by the popular lecturers at the University, without reference to the particular branch which they are studying.

in its events, in the society of your fellow-creatures, and in nature, you must refer to the eternal laws of Reason. By this means you will gain in two different ways: on the one hand, you will pursue the most difficult researches without weariness, even with pleasure, and you will not esteem that to be insignificant which the feebler eye regards as such, because your vision, rendered clearer by science, will distinguish the dawn of the light of Reason, by which it is illuminated: on the other hand, your conviction that Reason is everywhere manifested, in great as much as in small things, will lead you to trace out the secrets of nature and of the soul, where, without the light of the soul, you would not have suspected them to exist; so that what appears to the uninitiated as dead matter, will to you be a living source of knowledge.

With the belief that you are inspired by this true love of science, and that your spirit thirsts after wisdom, I wish you success in the new path of life now opening before you.

In the first place, I must distinguish you who have gained the peculiar approbation of your examiners, and I must bestow on you the well-deserved public approbation. Rejoice in the distinction you have gained, by the honourable use of your talents; but do not forget that it gives your fellow-citizens the right to expect much from you. You have proved yourselves to be distinguished youths; your country expects you to become distinguished men. Always bear in mind the honour it would be to be numbered among her ornaments, and the disgrace it will be to deceive her expectations. Yet, above every external consideration, however promising it might appear, hold fast to the True, the Good, and the Beautiful, for themselves; love them in spirit and in truth; and then you will always be in the path to true happiness, of which external lustre is but a feeble reflection. You, who have given proofs of distinguished knowledge, without having attained the right to public reward, will also, in the eyes of your teachers and fellow-students, participate in the honour claimed by those of good abilities, and thus have to maintain an honour already gained, and to strive after a still higher one.

And you also, who have not reached the same degree of perfection, or who have not been so happy in your power of giving forth your knowledge, do not be afraid of aiming at the

highest end; a strong will, like strong faith, may remove mountains.

Even you, fewer in number, who may feel your powers too weak to attain the end in view, do not despair. He who is pure in his intentions, and who has an upright love of wisdom, ought never to undervalue himself, and will not be undervalued by others, nor will he be a useless member of society.

And thus we, your future teachers, receive you with the best hopes and wishes. Attach yourselves to us, and we will not throw you off. Attach yourselves to your older fellow-students, that you may benefit by their matured knowledge and experience. They will meet you, just so far as you show yourselves worthy of their confidence, or they of yours. Attach yourselves to one another, not in the spirit of a guild or caste, but in a common love for science. Support and guide one another. And, finally, never forget that we all, teachers and scholars, should be united by one bond of spiritual relationship and love.

ANCIENT AND MODERN TIMES.

FROM THE ALMANAC FOR 1835.

Is the World degenerated?

THERE are many people who imagine that the world is always degenerating. This is not a new complaint; we meet with many passages in very ancient books that were written two or three thousand years ago, in which we perceive that the old people, even of that time, asserted that men were neither so strong, so wise, nor so upright, as in their younger days. We find that the same was asserted in all succeeding times. Now, if the world continued incessantly to deteriorate to such a degree that it was perceptible in the course of one generation, what an immense difference there must be between those men who lived twenty, thirty, or more centuries ago, and us who live now! Must we not then be very miserable when compared with them? If it were true, we should be obliged to submit to it—for it would be of little avail to fancy ourselves better than we are; but if it is not true, we must equally beware of believing it. We often hear a thing extolled and placed before us as an example, and for our imitation, merely because it is old; now, if we falsely imagined that every thing was formerly so much more excellent than at present, we should not have the courage to examine ancient times, as we confidently feel we have a right to examine modern times.

The Temperature of the Atmosphere has not altered.

I will first mention an unfavourable change, which in the opinion of many people has taken place in the external world, but which if it was really the case, would have a great

influence upon man. Thus, many people imagine that in the course of time heat more and more diminishes on the earth, while there are also some who imagine that the earth is gradually becoming warmer ; but we shall soon perceive that neither party is right. Frequently, indeed, a succession of unusually cold, or unusually warm years, succeed one another ; but this does not last. The question is, whether, in very ancient times, it was constantly warmer or colder than in our days, or whether a perceptible change has generally taken place.

Every one knows that Greenland is a very cold country, full of icebergs, which never melt, and that on the side towards the sea it is almost surrounded by ice, which makes the voyage thither dangerous, even in summer. It has hitherto frequently been said, that this country was formerly much more mild and fruitful ; that even in the time of Queen Margaret, more than four hundred years ago, it was so fertile that food could be exported from it into Denmark. We have now accurately searched whence this information proceeded, and have found that it rests upon a misunderstanding : as in an old book, that was written in Norway five or six hundred years ago, and called "The Mirror of a King," we find the ice in Greenland so described, that we can perceive no difference between the condition of the country at that time, and the present. We may take another example from the Bible. We there see, that in the country of the Jews, at the time of Christ, the vine was cultivated, as well as the sweet fruit called the date ; but dates do not ripen in any country which is of a lower temperature than Judæa, and in no country which has a greater heat can we have a vineyard which will produce grapes in abundance, without peculiar care. We therefore see that the country of the Jews, at the time of Christ, must have been neither warmer nor colder than in our days. We need only remember that we are in the year 1834, to see how long the temperature of Judæa has remained the same ; and yet we may go still farther back, and say that even in the time of Moses, which was 1500 years before Christ—therefore more than 3300 years before our time—it was not warmer than it is now ; for those men who Moses sent out to explore the land, reported that it was rich in grapes, and brought with them examples

of an unusually large sort. If it had been at that time warmer, it could not have been, as we have already explained, a rich wine-country.

Some believed they had discovered a proof that vineyards formerly existed in different countries where none are now met with, from this circumstance, that the training of the vine is mentioned among the privileges which the Pope granted to the monasteries of those places; but this arises only because the secretaries of the Pope dispatched similar privileges to the monasteries of different countries, without considering that there were no vineyards in the north.

The olive, from which sweet oil is obtained, grows in those countries of Europe which enjoy the warmest climate, in Greece, Italy, and in a part of France, but it does not prosper in colder countries. It does not extend farther north than the chain of mountains in France which are called the Cevennes, but even eighteen hundred years ago it was not seen farther north. We learn this from an ancient Greek book, written by Strabo, a learned man who lived in the time of Christ.

I might still cite many other examples of a similar kind, from ancient writings, to show that the earth has neither become warmer nor colder during the long period that man has kept a record of events which have come down to us; but we have not space for more at present.

Professor Schouw, who reports upon the weather of the past year, has collected and examined many such ancient records, and has laid before the Royal Scientific Society a treatise about it, from which I have borrowed these examples.

Men were neither greater nor stronger in ancient times.

It is related that, in former times, men were on a greater scale than they are now; but this also rests upon imagination and false conclusions. Remains of ancient bones were found, which, as some believed, must have belonged to enormous giants; but these bones have since been more accurately examined, and it has been discovered that they were not human bones, but that they belonged to large fourfooted beasts. On the other hand, there have been various opportunities of examining the bodies and skeletons of people who

died many hundred, indeed two thousand years ago, and it has thence been ascertained that those people, taken as a whole, were neither greater nor less than they are at present. In Egypt, a country so often mentioned in the Bible, people had the art of embalming their dead bodies in such a skilful manner, that they were able to preserve them to an indefinite period of time. These embalmed bodies, which are called mummies, were either kept by their contemporaries as holy relics, or were placed in large and strong public buildings destined for that purpose, or in vaulted graves, which were hewn out in the rocks. For this reason, we find them in great numbers even now. By examining these mummies, we perceive that there is no difference between the size of men two thousand years ago, and at the present time. The careless observer, who does not reflect that the body must shrink in drying, will even believe that they were smaller; but when we examine their bones, we see that the people who then dwelt in Egypt were neither on a greater nor smaller scale than they are now; indeed, taken altogether they were rather smaller than we are in the north.

In many other countries, skeletons and scattered bones are found, of which we can pronounce with certainty that they have belonged to men who died many hundred years ago; and wherever such are found, an accurate examination of all the circumstances shows that the size of man has not altered. Moreover, we often hear that people, in old days, were stronger than they are now. But this is not proved. It is alleged, amongst other things, in support of this opinion, that ancient armour is often discovered, which is so heavy that in our times it would be difficult for a horseman to move in it. In the first place I must remark, that we learn from ancient writings that this armour was considered burdensome, even at that time, and that it made the cavalry so unwieldy, that they were unable to defend themselves against courageous, lightly-armed troops, if the latter succeeded in breaking through their ranks. In the second place, we must consider that it was only by practice that they learned to wear this armour; people who exercise their powers on any one particular point, often gain great strength in it. We have also had an instance of this in the keeper of an armoury, who, when he was first appointed to the charge, was not remarkable for strength, but who

attained, by constant practice, such an ease in wearing and using this old armour, that he gave proofs of it, even in his eightieth year. Lastly, we must remember that the armour, which was carefully preserved, belonged far more frequently to the most robust warriors than to weak and feeble people. Old swords are also mentioned, of such a size that it would be difficult for men of our times to brandish them; but this ceases to be wonderful, when it is known that the warriors of those days, when powder and shot were still unknown, often carried swords which were wielded with both hands. Now that heavy helmets and armour are no longer worn, since they would be of little use in the manner that war is at present conducted, such heavy swords have been likewise dispensed with. We also meet with ancient swords of enormous size, which were borne on certain solemn state occasions. Those who regarded these as warlike weapons, must indeed have had a great idea of the strength of our forefathers. But on the other hand, the swords which we so often find in the graves of ancient heroes, and generally most of the arms which have descended to us from olden times, sufficiently prove that the strength of men in past ages was not greater than in our own days.

The duration of Life is not diminished. We now enjoy better Health.

Another idea, as unfounded, though similar to that above mentioned, was, that people formerly lived to a greater age than they do now. I beg you will remark that I do not go back further than 3000 years, that I may not have occasion to quote anything from the investigations of learned men who refer to the accounts in the Holy Scriptures concerning the first ages of the world, which might perhaps render me unintelligible to some people. But as far as regards the last 3000 years, it is not difficult to prove to every one, that during this period the usual duration of the life of man has remained the same. I can here quote the Bible again, as the most important testimony; in fact, the 90th Psalm, over which is inscribed "A prayer of Moses, the man of God," in which it is expressly said that the age of man is seventy, and sometimes reaches eighty years! Other very ancient scribes fix the age of man about the same period. In all these things

we must admire the divine wisdom, which has bestowed on nature such a perfect contrivance that it does not decay, like the work of man, but is preserved from century to century.

I must here add another remarkable thing. If we compare a number of very old records, among others, old parish registers, and notices of births and deaths from the time when they were first recorded, we find that in later times, out of an equal number of births, fewer die without becoming old than was formerly the case. The greatest age that man reaches, is not certainly increased; but the number has risen of those who attain a great age. Nature has remained unchanged; but the regulation, and the mode of living among men, have produced alterations.

I will cite the principal causes of these phenomena.

1. Men have by degrees accustomed themselves to more cleanliness. If we retrograde five or six centuries in time, we find, that even in cities the streets were unpaved, and that they were besides narrow and dark.

The dirt was great both in the streets and within the houses; on that account, all great towns were at that time constantly visited by pestilential diseases, which brought many thousands to the grave. Besides, the improvement in the ventilation and purification of towns advanced but slowly; though exactly in proportion as this progressed, infectious diseases became fewer and less fatal. Such a sickness as the last great cholera, would, 500 years ago, have probably been as frightful as the Black Death, especially as the common people, even at that time, lived much worse than they do now. They were also clothed in a less cleanly manner. Many people knew little about linen, consequently the skin was in want of a great means of refreshment and of cleanliness, that cannot now be dispensed with. On that account diseases of the skin of all kinds were very general, and that terrible scourge, the leprosy, made great devastations. Improvements proceeded slowly; and, even now, the streets, houses, clothes, or the body itself, are not kept as clean as is desirable; but what has gradually taken place is nevertheless of importance, and has been productive of good.

2. Men were formerly less moderate in eating and drinking than they are in our time. Many are certainly of a contrary opinion; but such people only consider how much luxury, which is still permitted, ought to be abolished, and do not

remember the long descriptions which have been handed down to us of what was formerly consumed at feasts. Men were, in past ages, particularly addicted to intemperance in drinking. At that time beer and mead were the principal intoxicating drinks, which contained more powerful ingredients than in our times. But to be intoxicated with these liquors, which are so innocent when taken in moderation, is far more injurious than with wine. The introduction of brandy, and the greater facility with which wine is obtained, has certainly contributed to remove the intemperance in beer and mead; but, on the other hand, brandy has been more injurious from its frequent use, owing to its cheapness. Intemperance in drinking, on that account, during a certain period, rather increased; but now we may indeed say, that in the last generation it has greatly diminished. In this respect the higher classes, particularly in the last century, have set the lower orders a good example. Intemperance in drinking is now almost entirely abandoned among those in a higher class of society, and on that account a greater number reach a healthy old age than formerly; but the amendment with regard to this is not so great, with many people, as we may hope that it will become. He who does not obey the religious precept concerning temperance, is indifferent to his health.

3. The science of medicine has made great progress, and we have a greater number of skilful physicians than formerly. Hence the folly of seeking to save one's life by superstitious means, more and more disappears, although it still exercises too much power. With the improvement in the science of medicine, many good regulations have, at the same time, arisen about health, by which infectious diseases are either kept at a distance, or are prevented from spreading further. Among these improvements the regulations for inoculation must be particularly mentioned, which were so strongly promoted by our paternal government, and which have saved the lives of so many children.

Mankind, in a moral point of view, has not receded, but has advanced.

We see that in what concerns material things, the state of man is not worse, but better, than it was in former ages. The question now only remains, whether the case is not

different with spiritual things? I know that many speak of the ancient times of the world as if they were replete with virtue, and as if the men of the present day had shamefully degenerated from their fathers. This commendation of past times has even less foundation than what is said about the size of the body, its strength, and its health; but I should act unadvisedly, were I not previously to explain why our ancestors must have been inferior to us in many good qualities. They were, namely, less enlightened, which was natural; for, as every ordinary man grows wiser with age, it is the same with the whole human race. Every year we experience something new, and we invent something new; the son learns from the father, and the young generally from the old. In this way an increasing treasure of knowledge is constantly collected in the world, which cannot be lost, unless men so entirely surrender themselves to folly and vice, that they do not even endeavour to learn anything good and useful. It is easy to conceive that men, in all well-regulated states, must improve, and be better instructed, and that their understanding is more disposed to choose the good and to reject the evil. It is worthy of remark, how often men allow themselves to be deceived by a name. We frequently call the past ages, "the olden times," and our ancestors "the ancients," and we fancy that we thus pay particular respect to their age and their wisdom. But what are called the "ancient days" were exactly the "young days" of the human race; mankind is now older and more experienced than it was in past ages; but we should not pride ourselves on that, for our descendants will be still better, and more experienced than we are. Let us only endeavour to leave behind us the remembrance that we have not disgraced the time in which we lived.

Valour was the virtue most usually met with among our ancestors. Exactly because men were less enlightened they were more easily roused into a dispute, and tempted by rapacity; and since countries at that time rarely enjoyed good governments and wise regulations, people lived in continual warfare. Each petty lord could wage war against his neighbour, and several petty lords, when united, were able to join against their sovereign. They therefore recognised no other virtue but valour, which they constantly strived after. In our days the passions of men are more curbed by reason, and, above all,

internal peace is better protected by laws and good regulations. We are also more cautious than formerly about commencing a war, by which the lives and welfare of so many men are at stake. Yet, notwithstanding this, when war has been waged in modern times, we have seen great actions performed, which might fairly take their place beside those of former days.

The praise which is bestowed upon the honour of ancient days, has far less foundation than that bestowed upon their valour. If we do not limit ourselves to reading certain modern books, which blindly praise the past ages, but if we rather read older writings, which are composed by men who have seen the events with their own eyes, or heard them related by men who have themselves experienced them, we learn that promises were often broken, that even perjury was not uncommon, and that near relations frequently deceived one another. We also find, in the old writings, that they treated one another with what we should now think a very exaggerated distrust. The petty kings, who swarmed in the North, before each country was subject to its own king, covertly attacked each other, although they did not come to open war. When heroes feasted one another, they were at the same moment ready for each other's destruction. It is true they were heathens, but in Christian times the great lords in these kingdoms continued, for many centuries, to act almost as badly; and certainly in none of the succeeding centuries was artifice so much detested as it is in our days.

Men of the present day should not fear a comparison with those of past ages, with respect to their probity and their love of truth; but they might well fear of blushing before posterity, if they do not earnestly strive to excel their ancestors far more than they have hitherto done. It might be supposed, that Christianity itself would imbue the most ignorant among its followers with a horror of all vices, and it will not fail to do so, when man devotes himself to it with his whole heart. But we should not forget that the imperfection of human nature makes it in various ways difficult for us to receive the simple comprehension of the great truths of Christianity, as clearly and purely as is intended. The enlightenment of the understanding is the real way to expel the animal part of our nature, which allows the wild desires and appetites to govern, and which is also frequently led astray by false ideas. If we

consider the path of Divine Providence in the distribution of Christianity, we see with admiration how everything is so arranged as to oblige man to acquire knowledge, to use his powers of reflection, and to advance in enlightenment. I do not however deny that men, in their endeavours towards enlightenment, have frequently fallen into great and detrimental errors; but if many honest men strive after truth, they will be gradually corrected.

We may here be contented to see how much good has already been derived from the enlightenment of the understanding.

Superstition is one of the most pernicious errors which prevailed in less enlightened times, and which has not yet entirely lost its power. In the dark ages, an extraordinary confidence was placed in astrologers, who foretold by the stars portentous events and the destinies of man. It was but slowly perceived that these prophecies consisted in mere imagination or deception, for only two hundred years ago most people still believed in them. Equal faith was placed in the power of magic. There were many, at that time, who willingly allowed the people to believe that they understood the diabolical art; indeed, some few put faith in it themselves; namely, they had learnt from wicked men some secret means of injuring others, and did not themselves understand the matter, therefore they easily believed that it proceeded from the devil. Some also learned a peculiar way of preparing stupefying drinks, which caused a kind of intoxication, and afterwards a sleep, in which people had singular visions, and fancied that they had been in distant countries, although their bodies had remained in the same spot. It is now well known to us how all this can be done, but its practice would at the present day be as much ridiculed as it would be shunned by all reasonable people. Must we not shrink from the idea, that not only in the dark ages of Catholicism, but even whole centuries after Luther had restored a purer form of Christianity, people yielded to such foolish notions; and above all, that so many both in the upper and lower classes could seek advice and assistance from men whose wisdom and power proceeded, as they believed, from the devil? The enlightenment of the understanding has here paved the way for Christianity; for as soon as we perceive that evil is folly, it is held in the greatest contempt. Future enlighten-

ment will gradually bring more and more people to the clear knowledge that all that is wicked is also foolish; and he who constantly keeps this truth in view, which is taught both by religion and by reason, cannot but feel himself through it strengthened in virtue.

Enlightenment contributes powerfully to extinguish revenge, cruelty, and pride, among mankind. Christianity condemns these vices in the strongest manner, and exhorts us with all its power towards love. We must be mentally blind, if in reading the events of the world, we do not see the great effect it has thus exercised on the numerous nations who have been received into the Christian church. But an attentive perusal of these events proves to us, again, that enlightenment has accompanied Christianity. The more Christians became enlightened, so much the more they were obliged to fulfil the commandment of love and humility. The two commandments are more intimately connected than at first sight would appear; for he who thinks a great deal of himself, and but slightly of others, is strongly tempted to forget love; indeed, to undervalue others so disproportionately, is of itself a proof of a want of love. I need not say much of the contempt with which these formerly in power treated the common people, and especially their own subjects; the case is sufficiently well known. A great many bad usages are connected with it; the pride of the master usually demanded the greatest humility from those beneath him. It is delightful to see what a great change has been introduced by the increase of enlightenment. As the upper classes became more enlightened, they found less delight in seeing their fellow-creatures humble themselves before them in the dust; and as the lower classes became more enlightened, their superiors found that they could both demand as well as deserve better treatment.

Thus it has come to pass in nearly all Christian countries, and our beloved Denmark has not been behind the rest. It must be well known to every Dane, how the oppression and contempt in which the peasants formerly lived, disappeared towards the end of the last century, and the share which Frederic VI. took in its extinction, who, long before he ascended the throne, had already done so much for his people. It also deserves to be remembered, that those who laboured in the cause by word and deed, were no peasants, and therefore were not those who had suffered the wrong, but that they were

men impelled by integrity, and love to their fellow-creatures. The most distinguished among these were the noble benefactors of the peasantry, the great statesman, Count Andreas Peter Bernsdorff, Count Christian Reventlow, so well versed in the internal constitution of his country, and the eloquent and learned lawyer, the general proecurator, Christian Colbjørnsen, who with the most unselfish zeal promoted this great endeavour, more honourable than the most successful war. Shortly afterwards, with the same philanthropy, we provided for the interests of our black brethren, who in another quarter of the world, had been previously sold like cattle, to be used as beasts of burden. Christianity and humanity have for nearly three centuries demanded the abolition of this shameful trade in men; but many persevered in it, from motives of self-interest, until the numerous and zealous friends of humanity who fought the cause of the unfortunate negro, succeeded in their efforts in enlightening them. The Danish king set the example of the abolition of the slave trade, and he who most zealously supported him in this endeavour was Count Ernest Schimmelmänn, who possessed large West Indian estates, which up to that time had been cultivated by slaves.

I only recall this to the remembrance of my countrymen in order that they may see in some of these well-known examples, how powerfully enlightenment has contributed to promote the Christian precept of love; for we vainly seek during the dark ages for such a wise and philanthropic action. We have not space here to enlarge upon the examples from other countries. I will only add, that the number of those who are labouring to diminish oppression, to alleviate the destiny of the poor, and even to reconduct the criminal into the right path, appears constantly to increase. The zeal with which so many have contributed to spread the knowledge of the Bible, is sufficiently well known.

Before I conclude, I must guard against a misinterpretation of what I have here said. I should be greatly misunderstood if it were supposed to be my opinion, that much good did not happen in past ages, and that many pious and noble men had not then lived. That would be at variance with clear truth. I should as little believe that great improvements are not wanted in our days. My intention was only to show that the world, taken altogether, is advancing towards a better

condition, and to point out the way by which man has approached a more desirable state, in order that we may pursue our path so much the more courageously in future, and that every one may promote in his own circle the distribution of useful knowledge, as much by the instruction of the young as by the enlightenment of the old.

NATURAL SCIENCE

IN ITS RELATION TO DIFFERENT PERIODS OF
THE WORLD, AND TO THE PHILOSOPHY
PREVALENT IN THEM.

A Critical Notice of Steffens' Polemical Journal for the furtherance of Speculative Physics. First Part. Breslau, 1829.—From the "Monatsschrift für Literatur," Vol. III., 1830.

THE best dispute, though one most rarely met with, is that which leads to reconciliation; and these polemical papers will certainly contribute much towards this end, if the author,* as we may venture to hope, will continue them in the spirit in which they have been commenced. They are intended to contain copious criticisms on the physical, chemical, and physiological theories of the day, as they appear from a speculative point of view; but the author will not speak the language of any one philosophical school. "Real living speculation," he says in the preface, "is not bound to the phraseology of a school. Each important part of the science of nature, while it developed itself historically, formed for itself a peculiar language. Criticism should cling to this, and verify her higher position through the prevailing modes of representation, rather than by speculative formulas. It is of course understood, that we would not meanwhile sacrifice speculative seriousness, to a shallow intelligibility."

As much dispute has ensued in the learned world from the want of a proper mutual understanding, and as this seems to be peculiarly the case in the dispute between speculative science and those natural sciences which follow the path of experience, the author's principle to employ the adopted language of each science, will contribute much to unite all minds. The first part is chiefly occupied in pointing out the

* Heinrich Steffens, late Professor of Philosophy and Scandinavian Literature at the University of Berlin.—Tr.

spirit in which Natural Science has developed itself during the last few centuries. We see in this representation the man of enlarged mind, whose view is not limited to one single science, but who rather surveys the relation of all science to the development of the human race. Should he even, in his bold attempts to discover the internal unity of things, occasionally fall into error—from which indeed, he is secure, who does not venture upon any bold attempt at all—we still cannot be surprised that there are many who would rather dare with him, even if they were to fall with him, than share the security of the latter. We will endeavour to follow the author, though not incautiously; but whether we always preserve the right medium between too little, or too much, this must be decided by others. Every one who knows our journal, must be already aware that the author's conviction of the great mental value, and the deeply influential character of Natural Science, as we have now to pourtray it, is by no means foreign to ourselves. The principal idea in Steffens' pamphlet is given for the most part very briefly, in some passages which are intended either to be still further explained, or to communicate the result of preceding researches. We therefore can generally allow the author to speak for himself, and so much the rather, as we may feel convinced that our readers will listen to him with pleasure.

“The view of nature generally prevailing at any determined time,” says the author, (p. 3,) “as it appears in different nations, marked with their peculiar stamp, is the foundation of their whole science, the medium of all their knowledge, while its influence spreads over every department of life. It has an important influence on all social order, on morals, nay, even on religion. It is the peculiar mode of viewing nature, which especially imparts a marked peculiarity to certain periods, by which they are distinctly separated from the earlier and later periods, and stand forth as peculiar and distinguished historical phenomena. We may venture to assert, that although the influence of prevailing views of nature cannot have remained hidden from historians (so that the more faithfully the picture of a period is delineated, so much the more distinctly does this influence appear), yet they have not yet recognised the whole depth, and the immeasurable force of this tendency of the human mind.”

Pages 3 and 4. “Even the doctrines of the schools are

more important than we are generally inclined to admit. Principles which have been there long contested as mere conjecture, which are grounded on investigations that in their widest extent never overstep the limits of the schools, and which have slowly grown up, not unfrequently become the prevailing view, and exercise a power over the minds of all, which the less it is acknowledged is so much the more forcible. What still continues to be doubtful in the schools, or at the most seems but a probable hypothesis, becomes an important guide to the mode of thinking among the people; and not unfrequently, views which have been formed by earlier schools, have been most powerful when they were here overset. In this manner historical movements have originated; violent struggles, now of one school in its growth, against that which is past; now of the new one, already become powerful, with the prevailing views of the people. The latter have resisted a change to which they are destined in the future to submit, in order perhaps, that centuries afterwards they might begin a similar struggle with the same violence, and with the same results."

The physical philosophy prevailing at the present time, considered as a peculiar tendency in the human mind, is modern, and really commenced in the 17th century, after, however, it had undergone a long system of preparation. "The traces of that period, now supplanted, have not even yet disappeared; they dwell in the views of the people: banished from science, they exist modified, though not essentially altered, in poetry—indeed few, not even those who are thoroughly penetrated by the prevalent doctrine which has a direct influence on the development of their minds, can entirely ward off the influence of a mode of thought to which they are directly opposed." And yet it is difficult to transport ourselves wholly into the mode of thought of those times, on which account the author thinks his representation of the case must be very deficient. His readers will certainly find it both interesting and eloquent.

P. 5. "The earth reposed in the centre of the universe, round which the heavens were arched. The moon, the sun, the planets on their wandering and apparently intricate paths, had each their peculiar heaven, their peculiar arch, in which they moved, and the action of this arch was concentrated at that point where the heavenly bodies appeared,

and therefore they came forward with still greater power, when they were united (in conjunction), either opposing or supporting each other. The firmament, with countless stars, stretched like a vast arch over the heavens of the planets, surrounded by the transparent crystal heaven, and by the light-giving fiery empyrean, and beyond, in mystic distance, lay the *primum mobile*. But the earth was in the middle: all the planets stood related to her, as to their common centre. The universal creation, with all its hidden powers, had become more closely united to the human race; their home was the whole system of the universe. The infinitude of existence was not directly revealed to them, but it was only as a phenomenon fettered and bound to the central point, and shining forth from that point, that it received in limited form its original importance."

P. 6. "As the earth was the centre of the universe, so that all sympathetic forces and materials here united to produce, to preserve, and to mould the completeness of existence; so man was the centre of the earth, the microcosm; and the planets acted with friendly or hostile influence at his birth, as they had co-operated at the birth of the first created being.

"The Father had disclosed all the riches of his creation to the earth, had entrusted it with the mystery of his intentions, —even the announcement of salvation through the Son was manifested in an earthly form; and as the whole power of the Father was thought to concentrate itself on the visible earth, so all salvation, through redemption, was to be united in one visible church, with one bodily head; finally, as the whole power of the Father was repeated in a limited form of creation in each individual man, so the incarnation of the Saviour was repeated for every partaker of the Holy Supper.

"And as nature lived and was preserved under the influence of foreign planets, so all that was mighty in history was borrowed from foreign nations. The foreign wisdom of a nation which had perished, and which could scarcely be recognised through the glow of eastern metaphor, composed in a strangely distorted form their whole science; a foreign imperfect language even limited their thought; foreign institutions regulated their towns, foreign rights their social relations, even religion itself was transmitted to them from

a foreign eastern nation ; the *primum mobile*, the original producing power in history, as well as in nature, was removed entirely out of their own hands."

P. 7. "And yet this only concerned their view of the subject. They were penetrated by the spiritual principle, although unconsciously, for they felt themselves placed in a centre, surrounded, not by a finite, but by an infinite circumference. Hiort* makes the correct remark, that the conception of organism was wholly unknown to the writers of the Middle Ages, and that the idea failed them, because they felt themselves absorbed in one vast organism. The idea of a universal life, in which all was swallowed up, was the *unconscious* support of their views, and therefore could never, as such, become the object of their consideration. It was from this tendency of the spirit, which seems so one-sided to us, that it was enabled to produce such great and mighty things—to produce, that is, a noble era, a joyous, significant poesy, a beautiful and characteristic art ; in short, an admirable character of its own, which we ventured to notice in a former writing. It was a notice which may seem to be guided by party feeling, to those who can never raise themselves above the individual historical facts, and who are not capable of bringing out in purity the inward producing spirit of an extraordinary period, from the confusion of circumstances, and to make it the subject of distinct consideration.

"But this was a necessary result of the peculiar spirit of the age, that the thinker felt himself bound by nature, with which he was both internally and externally united. He could not separate himself from it to make himself the object of his own exact inquiry ; each observation ended with something inconceivable and transcendental ; every reflection floated into a kind of prophetic feeling, and all precision and distinctness vanished, even where it endeavoured to form itself."

After the author has spoken of the four elements and their *qualitates primariæ* and *secundariæ*, he introduces the adoption of a *horror vacui*, as a first attempt to explain those phenomena which were followed up by experiment ; a theory, indeed, which was borrowed from the Aristotle of the Middle Ages, but of which we find nothing in the older physicists.

P. 9. "Because the idea of the organism was the instinctive principle of all their perceptions, and on that account

* In his work on the *Exigena* of Johannes Scotus, otherwise known as Duns Scotus.

could not be the object of reflection; the other principle that similar things seek themselves, did not appear as a mere dead attraction, but as sympathy and antipathy. For those above-mentioned qualities were the external forms of things; the deeper foundation, on the other hand, whence this attraction originated, sprang from the internal, actual, living forms."

This formed one of the most essential features in the character of those times. It was not believed that what thus sought or shunned each other were different in the living and the dead. "When the conjunction of the stars at the birth of a man seemed particularly favourable; when amber after friction attracted light bodies, and the magnet attracted iron; when minerals were found to move in dissolving liquids; when men by look, by word, or especially by secret influence, worked on one another, these effects sprang from the same principle. Even antipathy, the destructive agent, arose from the tendency of similar things to unite together. But they especially recognised one great separation, one original contradiction in existence; it formed the basis of their collected knowledge, and was of an entirely religious nature. It was the prevailing view of God and the Devil. The former was the principle of the invariable, the all-supporting, the holy; the latter was the principle of destruction and hostility."

P. 11. "This, however, was the important peculiarity of that period,—that as the earth was viewed as the centre of the universe, the *primum mobile*, embracing all matter, and God was regarded as uniformly penetrating all things; so also man did not behold the eternal in the spiritual, and raised above all earthly consciousness, but as bound to the microcosm of earthly personality, so that this never ceased to be the centre of all existence.

"Hence even their religion was an elevated and infinitely extended sensationalism; their highest feeling could not extricate itself from a form of consciousness which was bound to corporeal existence, and thus their whole physical philosophy was magic."

P. 12. "What were then considered as the highest scientific efforts of the magician, tended to separate the Divine Element, wherever it was found to be sullied by opposing elements in visible nature; in order that the divine and sustaining principle, which lay concealed in every inner form, might freely act. This is alchemy, no chance and arbitrarily imagined thought, but rather a thoroughly necessary and

absolutely essential element of the prevailing physics. All physicists searched for the philosopher's stone,—nay, were *compelled* to seek for it, for at that time there existed no other physics, and none other could arise. The production of this most noble centre of all existence, was as much a religious act as a physical experiment; and this general prevailing endeavour offers the most striking proof of the manner in which the spirit was bound to the earthly. This purified matter, in which lay concentrated the original force of creation, when applied to the macrocosm could not fail to produce the most noble materials, such as jewels: above everything, gold; but on the same principle, applied to the microcosm (because the original preserving principle is the same in both) it was likewise conducive to health and to the prolongation of life."

Pp. 12 and 13. "Superstition never arose of itself; it can never, in accordance with its first origin, be considered as absolutely arbitrary. The universal reference of everything to a state of consciousness fettered by sensationalism (although the latter was nevertheless penetrated by the entire fulness of *the All*) generated that one-sided, but in itself powerful and remarkable tendency, from which superstition originated, and was compelled to originate. Man lives in a constant internal dissension between thought and inclination, which he is never entirely able to overcome. But this inward struggle had at that time a deeper signification. The fulness of existence, the whole power of nature, stood opposed to the combatant, and it was necessary *he* should decide. That region of pure contemplation in which we feel ourselves, if not purified, yet still at rest, so long as we remove all phenomena to a distance, and entirely resign ourselves to *thought*, could then only be approached from afar, or the whole force of an undivided life was compelled to be sacrificed to the effort. Thus the inward struggle was heightened, and there was scarcely ever a more decisive one. He who yielded himself to the contemplation of the Divine, without quitting the position to which he was fettered by the times, who sought that purifying process through Divine assistance, that knowledge of the signature of things which revealed their connection with the stars and with the universal ruling powers; *he* was at once the wise and the holy man; his superstition, as we call it, was the faith of his time; he was, in the manner of that period, scientifically educated. But just because this

struggle laid claim to the whole of existence, to the sentiments as much as to the thoughts, it was rarely completely decided. That which we now enstamp and pardon as the *vanity* of philosophers; that which joined to great talent is often considered as a useful motive to evoke what is most important and significant, all this, at that time, took a much more dangerous character. The antithesis was thus formed between white and black magic; between that which originated in the preserving principle, and which in the usual acceptance of the term might be called orthodox, and that which originated in the destructive principle, which even in the sense of that period may be called *superstitious*, for all that it was able to produce was only illusion, although this extended farther, and was more powerful than we are inclined to admit."

We have been unwilling to hinder our readers from pursuing the train of the author's thoughts, and have therefore repressed every remark till we had reached this resting-point, that the reader might behold the animated and powerful picture which the author has drawn with his own eyes, not through foreign glasses. It lies in the very nature of such a delineation that some features should be often more sharply exhibited than they are presented by nature; but whether perhaps there are not certain features which have been comprehended with a preference which excludes others no less important, or whether certain features have been rendered too prominent in their relation to others, we will now leave to the judgment of the reader, and more especially to that of the author himself.

The whole description which has been given of the Middle Ages seems to produce an impression as if it owed its origin wholly and entirely to the views of nature then prevalent, and yet assuredly this is not the opinion of the author. The Middle Ages, with some particular exceptions, had almost the same views of nature as were held by Asiatic nations before Christianity, and yet the spirit of the Middle Ages was in many respects very different from that of Asia. That which gave the Middle Ages its character, by which it was distinguished from more ancient times, was doubtless the result of the remarkable intercourse which then existed between uncivilized races and other nations, whose intellectual development had reached an excess of refinement and become obsolete, and who were compelled to bend before the brute force

of human nature; but on the other hand, they not merely imparted to them the small portion of science which the others were capable of receiving, not merely exercised an immense influence on their language, laws, and government, but also communicated to them a new religion, and a religion truly which, with irresistible though slowly-acting power, was to exercise an enduring influence over them, and which at the same time caused foreign languages and the wisdom of the East to become a constant object of their endeavours. Other nations, with the same views of nature, had developed themselves to the greatest freedom; the obstacle which fettered the spirit of the Middle Ages was, that men were then compelled to walk in the leading-strings of foreign nations. If we were describing the Middle Ages, and only gave secondary importance to the views of nature, we should, in the first place, mention what the author himself (pp. 6 and 7) has said in such a striking manner, and so aptly, of foreign influence on the Middle Ages. That which was peculiar in their views of nature, and different from still older periods, was especially to be ascribed to this foreign influence. Even the Romish church could not have reached that powerful hierarchical form to which it afterwards grew, had not an ignorant population required such dominion, and gladly submitted to it.

Do not let us be misunderstood, as if we believed that the author would himself overlook this, or that he had said anything from which this might be directly inferred; but we do not very clearly see how far his idea of the case deviated from our own, and we hope that he will explain himself more clearly in the continuation of his work. That we may not prolong a possible misunderstanding, it may, perhaps, be useful to say, that we by no means understand by what we have just said, that the spirit of the Middle Ages had been composed from those co-operating elements. The spirit of each peculiar period is the spirit of man himself, more immediately determined by the development which it must receive from all preceding and contemporaneous impressions, as well from those which come from without, as from the reciprocal action of the various elements of intellectual development themselves; thus, for instance, the views of nature influence both religion and government, as these react on them. We do not, however, present these as chance coincidences, however

much they may have the appearance of chance in our eyes ; but as produced according to the eternal laws of the world, to which both the seasonable development of the human mind, and that of material nature, are subordinate. That these laws do not differ from the Divine Will, we consider as clearly proved. But as we always express ourselves most distinctly, when what we have to explain, points to that which is most nearly connected with it, and not to its original source, so we have also here commenced with the most nearly related subject.

That which the author says of what is excellent in the Middle Ages, p. 160, &c., is indeed most admirably applied, and he can hardly speak more upon the subject ; but it must be expressly told to the many blind worshippers of the Middle Ages, who particularly cling to the reputation which is attributed to that period, and who scarcely feel, with sufficient force, the actual depth of the shadowy side of the picture which he draws, that what was excellent in those days was but thinly sown. The barbarism and vice in the history of that period, appears to preponderate in a frightful degree. Let us only venture on a comparison ; the limit we fix upon may certainly be arbitrary, but we shall not be very wrong, if we choose the era of the discovery of printing, which is so remarkable from its causes, from its effects, and from the events which occur simultaneously with it. Let us now collect all which can throw glory on the Middle Ages, and unless we entirely close our eyes to later times, we shall be compelled to admit that they were far behind us in all which ennobles mankind, while, on the other hand, they as far surpassed us in examples of horror and vice ; though indeed it is with sorrow that the friend of humanity beholds a fearful number of instances of vice, even in later times.

The author discovers a remarkable peculiarity in the Middle Ages, in the fact that *reflection* by the understanding was entirely excluded. He will not allow the subtilty of the scholastics to serve as an argument against this, but says, p. 25, " If reflection by the understanding now pre-supposes an original separation of being and thought, and in such a manner that the thought appears originally empty, a mere faculty for the reception of the impressions of sensation, notions, therefore, become only the mere abstractions of concrete perceptions, and *through* these receive their reality

as they themselves did from their own original impressions; yet, in those earlier days there was no question of such a separation; notions were indeed abstracted from things, but the unity of both, if not recognised with distinct consciousness, was yet admitted. The notions formed themselves within the soul, as in a peculiar world, and yet this world contained all its external forms and relations; it appeared, therefore, as the *primum mobile*, which embraced and ruled nature, though separated from her as the eleventh heaven—and struggled for an internal, as here for an external, Infinity. On this account we perceive at that time a wonderful richness of the inner world of thought, down whose precipice we scarcely venture to look, while the *external* world was less regarded, and was only able to excite attention where it directly set in motion the most *inward* world."

With regard to the first circumstance, that reflection was a stranger to that period, the author appears to us not to have been fortunate in his manner of expressing what he would say; for the whole dispute between the Nominalists and the Realists, which so much agitated the philosophy of the Middle Ages, and which gave occasion to so many ideas lying between the two extremes, rested on the question of the reality of notions. As there is no doubt with regard to the chief object of this dispute, we may borrow for our purpose the following short exposition of it, taken from the first and best work on the History of Philosophy.

The fundamental principle of Nominalism is, according to Buhle,* as follows:—"Reality only exists in individual external things. Universals are merely notions of the understanding without reality, which are only designated objectively through language, and thence receive an appearance of reality, although they themselves neither contain a reality, nor do they correspond to a reality. The principle of Realism, on the contrary, is this: There is no reality in individual external things. Universals are the true reality, and individuals as such, are only distinguished by accidents."

We must, therefore, pause at another expression of the author:—"The undesirable impress which that period evinced of a limited consciousness," an expression which may indeed be defended in one particular signification; but which, as we believe, he ought to explain more exactly and historically, if

* J. G. Buhle, Professor at Göttingen.

in the succeeding numbers he would make a more extensive use of the views he has offered on the relation between the Middle Ages and Modern Times.

With reference to the form which in that age the inner world was compelled to assume, we indeed partly agree with the author, but yet find something in which we are compelled to differ from him. We will, therefore, offer our opinion for comparison; but to promote that mutual understanding which must be the principal object in every controversy where both parties trust to the honest love of truth in each other, we will express the thoughts which we borrow from the author, in our own words.

It is a matter of course, that spirits such as guide and form a period, possess in themselves a creative activity which they neither can nor will suppress; it becomes a necessity to them to form an idea of the world as a whole. The poorer they are in their knowledge of external existence, so much the more must they limit themselves to their own mental creative power. This does not leave them entirely at a loss, for it has drawn its essence from the same source as all the rest of existence, and will therefore frequently conduct them to the eternal laws by which internal as well as external nature is governed. But it is a necessary consequence of the limitation of human powers that this occurs very imperfectly. Truth is only now and then exhibited in its purity. Far more frequently the endeavour takes a false direction, and loses itself amidst countless errors. Mankind slowly advances through history and science, yet with a firm step, in spite of the errors to which it is subject on the path. It is only by the contemplation of real existence, that man receives such a clear view of the Divine power exerted in the vastness of creation, and of the inexpressible depth and harmony of reason in the laws of the world, as he is able to grasp with his faculties. But before the human race reaches this point, where the spiritual that is hidden is clearly comprehended in the material, it requires other aid. It is a well-founded compensation in the rational arrangement of the universe, that man discovers a treasure in himself, before he can discover that other, which lies external to him in widely scattered elements. We must therefore always admire the multitude of great thoughts and happy views, which are displayed to us in the earlier contemplations of the world during the childhood of the human race.

Besides, they possess this peculiar beauty, that the mind of man produces only such creations as can be easily comprehended by the mind of man. Finally, in addition, that these almost pure productions of the mind do not easily lose themselves in a mass of individual objects, but present the grand ideas with appropriate reciprocal nearness and connection to one another. Much indeed of this, but not nearly all, may be applied to the productions of the spirit of the Middle Ages. Externally it was under too much restraint for its productions to possess the same nature as the earlier ones of the human race. The spirit was, if we may so express it, nourished on foreign opinions, and not fertilized by mighty nature; and on that account the intensity of spirit which we discover, may be most nearly compared to the splendour of luxuriant flowers. The spirit of chivalry and architecture bear this scholastic stamp, and exhibit a certain subtilty, though we cannot deny besides, that a part of the eternal glory of nature (and indeed no small portion) is here manifested in the same degree as in all the other forms in which a period has developed itself. But in our own century we have again seen a similar mistaken tendency to appropriate the forms of the Middle Ages; so that our author, who does not justify this himself, will certainly agree with us in warning against such a tendency; even if he should not quite agree with our views of the period. There is something in the whole condition of our natural science which strongly induces us to prefer it to the older method of research. The great universal truths, which should proceed from our researches, are so scattered in the enormous mass of facts, that they are easily overlooked. We cannot, besides, deny, that the majority of naturalists lose themselves in *single* inquiries, and but too rarely look upwards to the whole. In passing this judgment, however, we must admit that the reason why a great universal truth is often *not* brought forward, may be that men are not satisfied with its certainty, until it has been proved, in clear accordance with experience; which from the imperfection of our thoughts, as much as our experience, frequently does not happen during whole generations. It, therefore, were much to be wished, that men of comprehensive and well-grounded knowledge, would more often attempt to communicate the great general truths towards which science has led; yet, at the same time, the

cultivated world, by instruction in the different branches of natural science, must be better prepared for its reception, a result which we certainly now see more and more prospect of realising.

On the difference between the magic of the Middle Ages and the physics of Modern Times, the author (p. 27,) makes the truly accurate observation, that in former times it was assumed that all similar things sought for union; in latter days, on the contrary, that similar things avoid each other, and that dissimilar things, on the contrary, seek to unite. But the progress of the last few generations appears to have removed this contradiction. Nothing is in opposition to itself, except so far as it at the same time possesses something in common; a line cannot be an antithesis to any thing but another line,—not to a surface, nor to a body: one kind of electricity can only be in antithesis to the other; the magnetism of the north only to the magnetism of the south. The same is proved in Chemistry. Those bodies which hitherto we have not been able to analyse must, therefore, have this in common, that they resist all our decomposing agents, even the most powerful, and have also such properties in common that they may be considered as one peculiar class, which, without meddling with hypotheses, we may name *the first class*.

In this way we recognise the antitheses of combustible bodies, and those capable of supporting combustion. These possess a great mutual chemical attraction, and, by uniting, form bodies of a new order of composition, which makes the second class, and consists of oxides, in the most extensive signification of the word, of chlorides, sulphides, &c. Acids and alkalis (in the most extensive meaning of the word) are the antitheses here; and, as is well known, the tendency to unite between these two groups is very great. These form the class of the salts, which is the third and last among inorganic things, at least so far as our arrangement of facts has hitherto reached. It is now, however, remarkable, that the bodies of the first and of the second, or of the first and third, cannot generally enter into direct combination with one another. Neither is it usual that bodies of the second and third class can be combined, if we except that which, in the second class, approaches the point of equilibrium or indifference between acids and alkalis. On the other hand, the

bodies of the same class, which stand in very slight, or almost unknown antithesis, to each other will combine, if they are not prevented by connection or something of that kind. In the present enormous mass of combinations, there may indeed still exist many subdivisions, in which the law to which we have pointed will be developed with far greater exactitude. It is sufficient to say here, that bodies, so far as they can be arranged without fresh inquiry, point to the law that there can be no union without a certain affinity; nor can there be a lively, well-marked union, by which the body assumes properties which conduct it into a new order of composition, and make it a new product, without an antithesis within the limits of this group; so that the same law, only far less defined, may be found to exist in inorganic nature as much as in organic, where new productions presuppose a union between beings of the same kind, but of opposite sex. Affinity thus would be the condition of union, antithesis of their action. Thus, the views of older times on the tendency to unite have some correctness, as well as those of later times.

With reference to the position, that things which possess opposite properties seek to unite, the author says that this happens, in the opinion of some, in order to restore a disturbed equilibrium; according to others, to remove a real antithesis. Ought these assertions to mean more than an expression for the same things in two different modes of representation? If we take the word equilibrium in its most extensive sense, where we can speak of electric equilibrium, magnetic equilibrium, &c., then every egression from the state of equilibrium is the result of antithesis, and every restoration of equilibrium, the destruction of antithesis. If we view things in their action, we may call antitheses opposite tendencies, and the co-operation of equal opposite tendencies, equilibrium. If we are right here, many disputes between natural philosophers and physicists would fall to pieces; for the same persons who hold it to be incomprehensible when we say that all antitheses of existence pass into an identity, will probably find no difficulty in granting that all moving forces form an equilibrium, as, for instance, all magnetic forces, all chemical forces, &c. But as naturalists have gradually become more acquainted with these antitheses, and have seen that many differences, which formerly appeared

incapable of being united in their first principles, are only different kinds of the antitheses of these forces, they are obliged to allow the probability of the fundamental principle which Natural philosophers represent as certain.

We here find ourselves obliged to omit much which deserves to be fully treated; but we must limit ourselves, that we may not find it necessary to write an entire book. We, therefore, pass over what has been said of Roger Bacon, of the predecessors of the new condition of science, &c., and (what we still more lament) we cannot, without being too diffuse, treat what the author says on the Reformation, of which most of our readers, even if we communicated the whole, would still be desirous of hearing a still farther explanation. We will limit ourselves therefore to the introduction of a few beautiful passages, which show the relation in which he places Religion to Science, and more especially to Natural Science. After having depicted the events and changes in the treatment of Science, which were prepared by the new period, he says,—

“The true regeneration of time, the germ of the entire living metamorphosis, was the Reformation; and it is not possible to develop its full meaning without pointing out, in anticipation, all the stages of its development even to our own days; nay, even to those which have not yet unfolded themselves.

“It is certain that the Reformation would not have come to light, without the frightful deterioration of the church. But this deterioration was the negative condition of its origin—the covering rent in twain, from which the new birth stepped forth. As the Greek wisdom, the enduring basis of all mental inquiry, so far as it can be termed purely human, stepped forth from the veil of disfigured myths, and refreshed the slumbering spirit; as the book of Nature, which was closed in distorted tradition, opened and invited spirits to direct research,—so that Holy Book, the only source of all higher life, was now to be presented to the whole race of man. The writings of the Greek philosophers were torn from the hands of sophistical speculators, the book of Nature from the hands of fantastic dreamers; then also appeared once more the revelation which had been mischievously suppressed. When this happened, the power of mere sensible phenomena, which had fettered and held down all free religious deve-

lopment, vanished; when the Holy Writings poured forth their life the magic which had infatuated the senses lost its force; the enchantment rose to a *pure sentiment*, and a living faith was again powerful in the world."

On the relation of Science to Religion, he says, among other things, (p. 57,) "It is indeed not to be denied, that the realisation of the highest idea of Christian faith only then begins, when it penetrates all those movements of earthly life which are rendered capable by grace of a higher blessedness, and not when, as in the earlier churches, the sensational and the earthly are regarded as the original element, which should be elevated as such to a higher position. On the contrary, the earthly when quickened by that which is higher, by grace, appears as a stepping-stone to that loftier truth which we have now recognised, gained, and believed in. While this higher idea penetrates the earthly, it is ennobled and exalted by it, and is viewed not as a good in itself, but as a stage of development towards a blessed world. The early church had however, entered into dangerous league with the sensuous; it was against this that the struggle of the regenerated faith was directed; and it was natural, indeed necessary, that it should at once abandon all which, according to its view, was infected with error, and was following a mistaken religious tendency. Thus arose a separation of all science from religion, unknown in earlier times, and, according to this principle, even philosophy for the first time became *worldly* wisdom." Every believer must indeed hope that all history and natural science will at some period be amalgamated with faith, but there must be a preparation for this expected time. Inquiry had become free by the separation of the earthly from the divine, and even the somewhat narrow view with which Theology was studied, could not destroy this freedom.

P. 59. "Every inquirer might expect that farther inquiry would lead to deeper insight into divine wisdom, but none could fear that a well-grounded unfettered research would lead to the discovery of feebleness in the divine guidance of history, or in the divine order in nature.

"Thus arose that flexibility and activity in all inquiry which created a new era. Natural science was especially promoted; for it could not remain hidden, that when historical phenomena came under consideration, arbitrary opinions exercised

a dangerous power over the subject that the views on history ; on the social relations of man, as much in the great circles of the state as in the smaller ones of domestic life, thence became unsteady, and shared the insecurity and mobility of opinions ; indeed, where they became fanatical through a dangerous connection with religion, they exercised a most mischievous influence on morality. Nature, however, exhibited a constant, invariable order, which, sublime above every erroneous opinion, by continuous research, destroyed every delusion which might still be clung to. Each opinion that was overthrown, became a stimulus for further inquiry and more careful examination ; the more insecure a prevalent view became, so much the more attractive seemed the eternal order and immovable harmony of nature to the inquirers ; and every mistake, instead of producing inward mental confusion, gave a new and more independent impulse towards that which made the inquirers always more distinctly cognizant of their inner affinity with the spirit, while apparently it withdrew them from a nearer approach to it. This deviation from the opinions generally entertained, did not produce persecution, or any external check, because the highest religious interests were only attached to philosophy by the hope of a future connection with knowledge being established, not by any distinct form of knowledge, which alone was to be considered as religious."

P. 61. He passes to the particular treatment of the influence of natural science on later centuries. "If," he says, "we would ask, for what reason the present time, as it has fashioned itself during the last three or four centuries, is so distinct from previous centuries, we must not hesitate to answer, that the chief reason of the peculiarity lies in physics ; and we hope, in pursuance of our representation, to make it clear that he who passes a well-considered judgment on our own age, if he overlooks the influence of this doctrine, does no more than touch the surface. Physics form a powerful centre, from which all the sources of knowledge have been attracted, as they unfolded themselves in all spheres of mental activity ; and in the widest circles, even where knowledge lost itself in action, and science in the product, its power is traced in every mental as well as external character of the period."

Copernicus' discovery on the system of the world is of

infinite historic value. Many, perhaps even in that day, felt how much would fall to pieces with the overthrow of the ancient system of astronomy.

P. 64. "But those belonging to the early church, where it was still powerful, must have most deeply felt how it was shaken by these views. When they appealed to that well-known passage in the Bible, they concealed their real fears. The immovable, invariable, visible government of the church could find no secure home on a moving planet, which circulated with another, round one common and more distant centre. The axe was laid to the root of all existing views of nature, the deepest foundation of all previous knowledge was undermined. The reflective consciousness of the age was becoming familiar with the past of its own mental history; a hopeful future disclosed to the inquiring mind the endless variety of living and dead forms; the religious consciousness threw off the chains of a fettering tradition and the delusion of works, and recognised the inner relation of its eternal personality to a loving and reconciled God. It was Copernicus who freed it from the last chains, so that it became at home in the whole universe. In every direction infinitude was opened to the inquiring mind."

P. 66. "The views of Copernicus were the boldest acts of analyzing reflection. The mind took root in the reposing earth, held fast in an embryo state, and all thoughts shot like the vegetable out of this integument, but could not dissolve the magic, nor break the bonds, so as to enable themselves, like the animal, to have a movement of their own." (We see that the author compares the fettered mind to the plant in the ground, which cannot leave its position; whereas the spirit freely moving through the whole universe, may be compared to the animal, which is not confined to any particular place.) "Copernicus destroyed the phenomenon, in order that we might determine it as one for ever. We say the *phenomenon*, for that which sensibly appears to all men in common is more than appearance. As he was the first, so also he remained the last. Although the whole of that period owes its peculiar development to this bold idea, no one had as yet ventured to suppose a semblance, behind other phenomena, which by explanation could be recognised as a phenomenon of deeper reflection. What prevented the physicists from choosing this path? It was this: in order that

a phenomenal world might stand in correlation with the original ideas of reflection, this world must appear as an outward infinity to the inward reflection; the original ideas of reflection, however, as an infinite aggregate of finite things. If there appeared anything in this aggregate recognised as infinite, and not brought under the conditions of sense, then the reality of the chosen point of view would have been destroyed; we will show with what iron consequence the advancing age retained the once-chosen point of view."

We have selected this passage because it forms an important link in the thoughts of the author, though the conclusion he arrives at, does not seem quite clear to us. Perhaps it may not be disagreeable to most of our readers, if we endeavour to express the meaning, as far as in our power, in other words. We think it is this:—In the earlier views of the world, the mind was accustomed to imagine all existence to be, as it appears to us, visibly, but not as a phenomenon of very different reality, which could only be contemplated by the eye of reason. There was no question here of a common deception of the senses, but of a necessary conception taken from the customary point of view, by all men; which nevertheless was infinitely separated from that to which we are led by a deeper insight. But if reflection were to stop here, then the variety of objects amongst which it had discovered a connection, must at once appear to it as independent. If we attempted to resolve them again into phenomena, we must remove the reflective point of view somewhat further back, and form a new world of thought, whose greater resolvability might be again questioned; but in the direction which was taken in the first mode of reflection, we should scarcely have felt induced to advance with firm footsteps. The author does not now point his censure against that extreme solution of all reflection, in consequence of which the whole of existence in space is only a phenomenon, whose foundation is alone found in the eternal forms of reason; for no physicist, but, as is well known, the philosophers of all periods, have ventured to hold this opinion. But physicists would not venture as physicists, for it is really metaphysical; that is to say, it is something which, in the ascending order of research, follows physics, or, in other words, lies beyond them. But by various hints in the progress of his work, we might perhaps surmise that he had this point in view, namely,

that as the movements of the world are the manifestations of a more *essential* existence, so also we should consider bodies not merely as phenomena of a super-sensual existence, as in metaphysics, but as active forces whose existence is proved in the way of experiment. Towards this, however, the whole of chemical science tends, although hitherto it has certainly not yet reached the stage of development which corresponds to that which Copernicus reached in astronomy. The various researches in science, partly such as were instituted many generations ago, tend more and more to such a result. It was known long ago that solidity, liquidity, and the gaseous state were forms of bodies which depended on an internal condition of heat; but we arrived at the erroneous conclusion that solidity was the fundamental property of bodies, while the liquid and gaseous bodies were viewed as solutions of solid bodies in the admitted caloric. But now that the conviction became more general among the physicists, that heat consists in radiated action, which has an affinity with that of light, and that inner heat may itself depend on heat-radiation: then this theory of solution falls to pieces, and the three conditions of matter may depend, as we may admit, on the unequal velocity with which inner heat-radiation takes place. It is supposed in this representation of the case, that in all bodies there is an incessant inner movement, and between all bodies an incessant giving and taking of radiant heat, an uninterrupted inner action, which formerly the mere chemist scarcely dreamt of, and to which he now hardly pays sufficient attention.

Electro-magnetic action, on the one hand, has proved that a circulation accompanies every chemical action, whether, with the discoverer, we place the circulation in the electric form of action, or, with Ampère, in the magnetic. But as everything is incessantly occupied with a reciprocal chemical action, so also electro-magnetic action flows incessantly through everything, and all this is penetrated by a hidden circulation, invisible to the eye, but clearly apparent to the mind.

The atomic system, which is a completely metaphysical system, has but few defenders among the physicists. They regard it as a question which does not concern their science, whether a continual division, carried beyond all the limits of possible experience, would at length lead to indivisible small bodies of determined form and infinite hardness, &c. But,

on the other hand, they do not see any proofs of the opposite system, that all bodies, at least all liquid bodies, must be perfectly connected (constant) occupants of space. They consider it much more probable that the plastic force of nature penetrates the inanimate as much as the animate, from the larger down to the smaller parts, beyond the limits of our perceptive faculties. Bodies, in their opinion, are connected by intervals (*discretæ*). The position maintained in Kant's dynamical theory of nature, that chemical union is an infinite penetration, in that every constituent in chemical composition fills all space with perfect connection (*continuity*), is held by them as incompatible with chemical experience, which frequently proves that the same materials, even where there is the same relation of the multifarious constituents, form different chemical results.

An ample experience has shown a connection between chemical compounds, and the forms which bodies assume. But the physicist, who is tied down by no metaphysical system, neither admits that the crystal is produced from its elementary parts, as the house from bricks; nor, on the other hand, that each crystal is a perfect connected occupant of space; but he admits mutual dependence between the parts and the whole. Every body, however, has a tendency towards a certain *form*, and so far as the different forces neither destroy one another, nor perish together, these forms would be still more compounded, the more numerous the fundamental constituents.

Now if we can admit that there is the smallest possible space for each figure to form and to preserve itself, then there must exist elementary parts (*moleculæ*) of a certain magnitude for each composition, which, however, are infinitely removed from an atom. The elementary part cannot certainly be divided without ceasing to be a thing of the same kind as it was before; but nothing prevents us from conceiving that it may be resolved by division into parts of a *different* kind. The atom, on the other hand, must in every way be indivisible. This manner of viewing chemical combinations has, indeed, come into such bad repute with dynamical philosophers, that many chemists do not venture to confess to it; but, as we do not believe that the arguments which can be brought against it are really so alarming, we will not allow ourselves to be deterred.

It may be mentioned in passing, that with reference to what has just been said, we cannot agree with the author when he accuses those physicists of inconclusiveness who have assumed *moleculæ* in place of atoms. Atoms, namely, belong to a supposition which lies wholly beyond physics; *moleculæ*, on the other hand, to a supposition which claims no more validity than what results from this, that they are necessary to understand observed facts.

Whether the fundamental parts are solid, fluid, or gaseous, is a question which is founded on misapprehension. Solidity, liquidity, or the gaseous form, are conditions which only refer to masses which already form systems of fundamental parts, and not merely fundamental parts themselves.

All inner heat-radiation passes between these fundamental parts. The greater number of fundamental parts in a certain space, and the greater reflections of heat, so much the greater, it is evident, is the inner heat; in other words, if all other things are alike, so much the greater is the total amount of heat (specific heat). We see that this doctrine agrees with the beautiful experiment of Dulong. We now also easily perceive, that when a body is placed in a new condition, in which the fundamental parts either approach nearer to one another, or enter into a relation in which they less easily yield, and therefore repel more powerfully, all the mutual radiations are completed with greater velocity; the body thus gives out more heat-rays from itself, but, inwardly, retains a smaller amount of them. It would thus, as is said, give out more heat, but retain less. This, however, happens every time, when the body is either brought into a smaller space, or approaches still closer to the condition of solidity. On the other hand, when it passes to a less degree of density or to a greater internal mobility of its particles, according to our principles as well as our experience, the contrary effect takes place.

If we unite all this to our more generally extended knowledge, we see that the physicist cannot admit into his science the conceptions common to ordinary life, namely, that material existence, so far as it strikes our senses, is actual *reality*, and the bearer of all other reality. He must not alone grant that the properties of bodies depend on their chemical nature, (a fact which has been long perceived,) but it must stand clearly before his mind, that bodies are only

phenomena which are produced by active forces, of which no single one is in itself a body; even more than this, he cannot view bodies as something constantly existing, which is so entirely the silent supposition of the experience of ordinary life; he must perceive that that which is, does not exist a single moment by *itself*, but only through a constant reciprocal action with all that surrounds it, and more or less directly with the entire universe.

We have certainly not found it necessary to call in the aid of a new doctrine, to prove that the physicist must perceive this. He has already long been forced to say to himself, that that which we *see* in the body is its effect on light, and through this on our eye; what we *feel* in it, are repelling or attractive forces; what we *smell* or *taste* in it, are chemical effects; in short, that all we know of bodies is, only that there is something active in the space which they occupy.

We have already had occasion to consider bodies as depending on a constant reciprocal action, but recent discoveries appear, nevertheless, to contribute much to render the idea we are now treating still more vivid.

We hope that there will not be many readers whom it is necessary to inform, that it is always, not merely important, but absolutely necessary, in the experience of ordinary life, to conceive of bodies, and to express ourselves about them, in the usual manner: just as we say the sun and moon rise or set, although we know very well that it is only the revolution of the earth which alters their position. Even in the very first principles of science, we remain at the same point of view; and the astronomy of the spheres offers us a well known example of this. But physics as little as astronomy can *remain* at this point; it must clearly embrace the great truth, that all bodies are only phenomena, which are produced by invisible, constant, active forces.

The passage before us, which we have treated in such detail, offers an example of the difficult modes of exposition which are so often found in the writings of German philosophers, and which yet the author has sought to avoid in the present treatise. But, perhaps, we might demand more from a man with his gift of representation. It is worthy of remark, that the philosophers of Germany have too frequently shown entire indifference with respect to their style. Even the complication of their sentences is a

great obstacle to their being read; for though it is indeed easy to construe an intricate sentence, if it is correctly formed, (which is not always the case,) yet a difficulty incessantly repeated is extremely fatiguing. This difficulty is much increased by the great assemblage of technical terms. But not only do we meet with difficulties in the style, but also in the whole arrangement of the plan; we find too little care to make the difficult matter as comprehensible as the nature of things permits. As the mathematician has not fulfilled the demands of his science, if he does not bring his demonstrations to the greatest possible brevity and clearness, so also the philosopher has not certainly fulfilled far greater demands which are before him, if he has not first brought his thoughts to the utmost maturity and clearness before his own mind, and thus has endeavoured in his representation to carry back the truths to their shortest and most visible expression. In the scientific style of some few we find a love which embraces, undivided, not merely the truths themselves, but the reasoning beings which are to receive them, and which gives a wonderful force to their statements. This, perhaps, is more clearly exemplified by Pascal than by any other philosopher. Although many will be little inclined to believe this, it is nevertheless true that this character may be also discerned among mathematicians, and among others, in Euler, who was as worthy of admiration as he was amiable. In Fichte this love of truth appears with such distrust of the capacity of his readers, that we are overwhelmed with unnecessary explanations, and on that account we are apt to lose sight of the right point of view. With most other German philosophers, we discover a similar undervaluation of those who do not stand on a level with themselves. This is sometimes expressed by a proud reserve, sometimes by a haughtiness, which now has been so often imitated by intellectual Don Ranudo's, that those who feel themselves inclined to it, by a certain feeling of their own strength, should be deterred, when they behold their failing through such a frightfully strong magnifying power.

It is doubtless unfair to require a finished discourse while the ideas are scarcely matured, and while opponents cause one to take a peculiar course in the statement of them. But we think that it is time to say, that more ought to have been done than has been done. Speculative philosophy, doubtless, by

the obscurity of style, which neither does nor can belong to its nature, has frightened away many of the friends of truth, and attracted many of those who are merely imitators. However, it will soon be seen that the present censure only applies to certain passages in the treatise before us, and that we have no intention to deny a well-merited reputation to the spirit and eloquence which are exhibited in the author's discourse. The reader will find a fresh example of this deserved reputation in the following passage, where the author, in reference to the discovery of the telescope, speaks of the spirit which rules over all the apparently accidental coincidences by which great mental changes are prepared.

“ This important gift was presented as from a hidden hand to the excited spirit. Could it have been chance? Survey that period in all its relations; how, in the most different directions, spirits the most opposite in nature understood each other; how buried treasures disclosed themselves; how a new world was presented to the astonished nations; how chance and fortune, nature and soul, met together; how thoughts, like lightning, darted forth here and there, as it were, without connection; how a secret bond influenced the most distant events, all armed to disturb a period that had reached maturity, all full of fruitful seed to give birth to a new period; and if God has endowed you with an organ to trace the development of the common principle of life, then you will recognise what is always to be found, when a new period is being ushered in.”

As such ideas, especially when they are separated from their proper connection, may possibly appear to the reader a mere effort of elocution, we will add a few words ourselves. All the laws of existence are the laws of reason, but not merely an assemblage but a system of such laws; in other words, an arrangement of reason, in which every thing viewed in relation to its origin proves itself *necessary*, and viewed from its results proves itself to be *wise*. All that takes place is prepared by what precedes, prepares what follows, and is connected with the whole. Although this happens everywhere, it is yet exhibited in a very remarkable manner, when we consider the great periods which change the human race, and which at the same time make turning-points in the flow of human events. He whose mental eye is not yet accustomed to discern the inner living connection of these

things, will here arrive at it most easily; he who already knows it will feel a heightened pleasure and satisfaction in the consideration.

The writer of the present criticism once intended to treat the remainder of the treatise before us with brevity, but was led both by the author and the subject beyond the limits which he believed he ought to keep. He must therefore, from this point, deny himself the pleasure of communicating more from this paper, with the exception of some short extracts, or of dwelling more frequently on particular passages. We will therefore confine ourselves, in what follows, to the notice of different passages where there is a hint of the polemical views of the author, which were first intended to be published in succeeding numbers. We think he will often feel himself tempted to combat views which have already begun to be abandoned by experimental philosophers, and that he will not be able to stand against the explanations which experimental philosophy can give.

The author says much against fictitious Matter, such as heat, light, electricity, magnetism; and he promises to contest these points still farther. But I think that they will be forced to leave the battle-ground, without the interference of so powerful an adversary. It has been rendered exceedingly probable, by the latest investigations, as we are ready to admit with him, that light is produced by vibrations in a generally distributed subtle matter, which we call æther; but if light consists in such vibrations, radiant heat must equally consist in this, and it is already long since we have had sufficient reason to consider heat as a radiation, which is only distinguished from light by slower vibrations. But the facility by which we are able to change electricity into heat, whenever we lay obstacles in the path of its stream, seems to betray that electricity no less depends on vibrations, and that these only require to be brought nearer together, to constitute vibrations of heat. This, besides, is still more strongly confirmed by the fact, that heat passes by good conductors into electricity, as we perceive in thermo-electric experiments; although circumstances must also occur, by which the direction is immediately determined. Magnetic actions are inseparable from electric ones, and differing as they do from the latter only by the direction of their action, which is perpendicular to the electrical, it would be exceedingly strange

to assume a special matter for each. Every one who knows the chemical electric researches of our century, will easily see, how much even our conceptions of chemical actions, and consequently also of chemical compositions, therefore of all bodies appearing in daily experience, are dependent on them.

The author thinks that this is just the time to originate a physical philosophy of qualities, which, as he is of opinion, is unknown in the hitherto developed doctrine. We answer that natural science has never been so much bent on resolving qualities into quantities as at the present period. What can deserve the name of quality better than colours? But, according to the system justified by the author, as well as ourselves, colours only differ by the unequal velocity of vibrations, by which they are produced. We can even measure the breadth of their waves. The author considers the doctrine of our period on light, to be full of hypothesis, which he compares to the Ptolemaic doctrine of the system of the world; but if he does not wish to follow the system of Biot, to which we can scarcely find any adherents, he will not be able to prove this. Let him represent the results of the present period with the same impartiality which he has exhibited in that of the past, and we venture to promise that he will not be less satisfied with them.

It is true that in our text-books natural operations have an appearance of dismemberment, and a want of connection, which is the reason that many can find no unity in them, but still it does exist. It is, however, certain that chapters devoted to a general oversight should be introduced into the text-books, by which the spirit of the whole may be embraced.

When the author says that Volta's battery, in physics, has become a Tower of Babel, he appears to lay too much stress on a mass of disputes about different conditions on which there should be no dispute at all, because we have not yet discovered the facts which can loosen the knot. But should it not be considered a great gain that we have come to the decision that acidity depends upon the same forces as that which supports combustion, and that the alkaline quality depends upon the same as combustibility? or that chemical actions may permeate through bodies without being attended by matter? That the system adopted by chemists is not in itself so connected and arranged as it might be with the materials offered, no one is more inclined to grant than the writer of the present

notice. But the author seems to have formed much too unfavourable conceptions of our period.

P. 119. "No human mind can penetrate into the inner part of nature, say the physicists; we content ourselves with viewing nature as she is, say they, and in abstracting universal laws from *experiences*, surrendering all claims to knowledge of first causes. But what do you understand by universal laws? Only such, by which whatever appears without order in nature is recognised by the inquirer as united to a higher unity. If, however, that which you recognise in an abstract unity now, only serves completely to scatter that which nature and which your experience offer to you as a unity, so that this which truly *is*, changes in your hands into an entirely lawless composition of your abstractions, what have you gained?"

To this we answer, that even if many naturalists say that the laws of nature are abstractions, yet this is not true. They belie themselves from a want of philosophical research into their own beings. The discovery of a natural law scarcely ever occurs by mere abstraction. It is a fortunate glance into nature, by which the rule is discovered through which she acts. We convince ourselves of its correctness, by causing nature to act before our eyes, and to express her laws under the most different circumstances; or we search for a phenomenon in wide-spread nature, in which she expresses herself in the most distinct manner in accordance with the present knowledge. It is with naturalists as with other artists; they think and act correctly, in consequence of a fortunate suggestion, which they owe to a peculiar turn of mind, united to a closer and more intimate acquaintance with the matter. But, nevertheless, they only philosophize moderately on the nature of their whole art, and this will be especially the case when they have obtained a sprinkling of school philosophy, which is certainly worse than nothing. The most beautiful discoveries in natural science have sprung from researches which were undertaken according to the demand of reason. Was the fundamental law of electricity or the electrical nature of light, and the lightning conductor, discovered by an abstraction? Was Volta's condenser and electric battery, or the laws on which they are founded, discovered by an abstraction? Did the physicists, after they had adopted the opinion that all kinds of earth were burnt metals, wait till all the

earths had been examined in reference to this, or were they not rather already convinced as soon as they found that it answered for one? It is quite a different thing that they did not consider the claims of science satisfied, till all kinds of earths had been submitted, in reference to this, to a research. It is also very possible that some physicists may have expressed themselves too strongly on the slight uncertainty which still hung over it after the first discovery. But it is quite evident that all their endeavours betrayed the conviction of the universality of the laws of nature.

It is equally certain that all naturalists who have vigorously promoted science, were penetrated by the conviction that all the laws of nature are laws of reason, although this was rarely expressed with distinctness. But the confidence with which they had derived one natural law from another on the principle of reason, proves sufficiently that they take for granted they shall find in nature what reason promises. At the same time, this pre-supposition implies that the laws of nature form a system of laws, and as this is a system of the laws of reason, it thence again follows, that all nature is an arrangement of reason, and that it is the business of naturalists to seek for reason in nature. We willingly confess that this is not very evident to all naturalists; but we believe that none who have really attempted to inquire into nature herself, will deny it. As to what mere book-makers say, this naturally does not apply to us.

The author says further (p. 119), "Simple substances are the substrata to physics, as the roots of words are to language. We select two, silver and diamonds. How do they appear in your text-books? In the tables of specific gravity, of absolute and relative cohesion, of refraction, of the conduction of heat, of specific heat, of the electric conductor and isolators, in the tables of galvanism, of electro-magnetism, of thermo-magnetism, of chemical affinities, &c.? We find them introduced with some of these properties, determined in their gradual relations, even to the fourth and fifth decimals. And now bring out what has been so dismembered in your tables, and place it together. And is this silver and the diamond? How can we hope to behold these properties in one unity, which is the very same as actually exists in experience, notwithstanding the point of view on which you have placed yourselves, is that of sensible experience."

We will not pause at the inexactitude the author shows when he expresses himself as if the physicist did no more with undivided bodies than inscribe their properties in his tables; while really he seeks to give a complete notion of them, by presenting to us their *united* qualities.

It certainly was not the intention of the author to raise such an unfounded excuse. But if he requires that a unity should be presented in these properties, he requires something which can scarcely be performed in that which hitherto has been undivided, and which he himself could scarcely do. But the most important point in the whole censure, is the use which he makes of the assertion, that naturalists have placed themselves on the basis of mere sensuous existence. The nature of experimental science is undeniably this:—that the inquirer proceeds from experience, permits himself to be guided by it, and uses it to confirm the ideas which he forms for himself on the events of nature; but he seeks for reason in nature with all the powers of his mind, and does not remain at the mere sensuous point of view. It is things *in their growth* which he should make the object of his science; what he could not see while it was produced, he must leave as that which is sensibly given. Elementary materials are certainly his radical words,—and must not the grammarian leave most of the radical words unexplained?

It appears that the author in these pages entirely deserts the clear view of experimental science which is to be found in the preceding pages. For instance, he offers as an argument against the law that *heat expands all bodies*, that there are real exceptions. Granted that there are exceptions to this, for which we could not account, shall such a universal comprehensive law, which is exhibited in such a countless number of natural events, no longer remain a law? In that case, the law discovered by Newton on the motions of the moon would be no law, so long as the grounds were not found for the many small deviations which were not discovered for a century afterwards. That water expands at a coolness of 4° centigrade, is certainly an exception; but this we easily perceive is connected with the changes which occur in the position of the parts by the force of crystallization, which certainly begins to act before the freezing point. This is not indeed enough to satisfy us, but sufficient not to allow us to consider the fact as an important exception. Sulphuric

acid and water yield far more heat than we should expect by their less degree of condensation, when compared to the heat that is yielded by the far greater condensation of the gases. But it appears to be a law that the condensation of solid bodies yields far more heat than that of the gases. This subordinate law accounts for many deviations. As for the rest, all physicists willingly grant that the doctrine of heat, as well as all other portions of natural science, is still very imperfect. But they believe that it will be brought nearer to unity and other perfection by a further application of the experimental method hitherto employed with so much success.

We have considered it our duty to meet this treatise with candid opposition, as well as with an open acknowledgment of the many excellencies which it contains. If the author will now with impartiality himself say that, which the accuracy of the different kinds of experiment of the present naturalists can explain, we doubt not that his treatise will contribute much to the distribution of an intellectual comprehension and representation of natural science. This already is accomplishing much. If he desires to accomplish more, we wish, although with some doubt, our renowned countryman all possible success.

To the real searcher after truth, we joyfully add our "God speed you!"

CHRISTIANITY AND MENTAL CULTIVATION MUTUALLY SUPPORT EACH OTHER.

Speech delivered in the year 1826, at the Festival in celebration of the Thousandth Anniversary of the Establishment of Christianity in Denmark.

It might appear as an absurdity in the history of mankind, when viewed from a superficial point of view, that the recollections of great events are celebrated after a certain number of years have passed, although it is easy to perceive that the number of years, whether they are a hundred or a thousand, have no sort of natural connection with the events themselves—inindeed, possess nothing to distinguish them from other numbers, except that they form marked points in the manner of computation which we have thought fit to adopt. But if it is allowed that, in the course of time, we seldom find an occasion of universal validity to renew the recollections of great events, we are compelled to seize upon an arbitrary one; for it is natural in man to rejoice in the recollection of what is glorious, and to delight in this enjoyment in a still higher degree, if he rejoices with sympathizing companions: and is not this delight in the recollection of the Glorious, allied with the noblest feeling in man? does it not elevate his soul? does it not enlarge his vision? does it not inspire him with noble resolutions? People in general pass their time in occupations which far too much limit their views within the small extent of time and space most nearly surrounding them; they are easily led to dream away life, as if there existed nothing greater beyond. It would certainly be wrong if we could remember no more in life than festivals of distant recurrence. If the soul had not been from childhood imbued with noble germs of knowledge, if religion did not every week raise mankind from the narrowness of earth to the greatness of heaven, if Christian festivals did not occasionally arouse

us still more forcibly, to elevate our souls towards the Eternal One, it would be folly to expect any effect from these great but scattered days of commemoration: but in connection with the others, those days dedicated to more elevated thoughts, do not appear to me to be unimportant, especially in so far as they act upon our mind, by leading us to something human which is connected with the Divine.

By virtue of my academical office I have been called upon to-day to speak at a festival of this nature, and indeed at one which is allied with the noblest recollections and sentiments. A thousand years have passed, since, for the first time, a king of this country became a Christian. It is true he did not reign over the whole kingdom; and his conversion to Christianity was not indeed immediately followed by the conversion of the whole nation; but this event, which planted the first seed of Christianity among us, is nevertheless most worthy of remembrance, and well adapted to fill our souls with gratitude towards the Eternal Wisdom which has guided us into this path. All the churches have commemorated this event as a religious festival; the University has solemnised it, by conferring the highest dignity in theology upon chosen, learned, and religious men, and we have heard the meaning of this action discussed in the learned and eloquent discourse of the respected dean of the theological faculty.

May I, who speak in the name of the whole University, be now permitted to show how Christianity promotes the development of science and of intellect, and, on the other side, how this is again favoured by them. Sometimes the enemies of Christianity, and sometimes those of science and of enlightenment, have attempted to throw a shadow upon this truth. But with an inward conviction that the kingdom of truth can never be at variance with itself, I believe that we cannot be too zealous to prove its universal harmony, in order that not only the honest, but the feeble friends of virtue may not be seduced by the confusion of parties to quit the path which leads to their great end. I confess that I do not enter upon the discussion of my subject without that fear which is grounded in the feeling of what this honourable assembly might expect from me, and what I am able to bestow; but if it is found that I do not arrive at the eloquence with which the subject deserves to be treated,

I still rest on this, that I speak before an audience who unite not alone justice, but indulgence, with their knowledge, and whose love of truth will dispose them, from the commencement, to regard the subject of my speech with friendly interest.

It is well known that science began to decline about the same period of time as Christianity was promulgated, and at length obtained the mastery. This has contributed much to the very erroneous idea, that Christianity has injured science. But impartial history points out to us, not merely that science began to decline before Christianity had perceptibly extended itself, but it also shows us the causes of this decline, namely, the unheard-of immorality prevailing in the Roman states, which was a preparation for the inundation of the barbarians, and which also nearly extinguished the last spark of the light of science. That which was lost, was not however lost through Christianity, but what remained was through it preserved and restored; because that belonged to its nature, and in this respect no religion can be compared with ours: for although most religions owe their origin to one or more highly-gifted men, and look to the improvement of mankind as their aim, yet they are generally opposed to the intellectual development of the human race, whereas our holy religion is most intimately united with this development.

While its principal dogmas have been separated so distinctly by Christ himself, that they may be understood by the most simple, yet every one who has any desire for inquiry, feels himself called upon to study the collection of sacred books to which Christ and his apostles so frequently allude, and to read and diligently weigh what those highly-gifted men, who were permitted to draw their knowledge from the mouth of the great Teacher himself, or were otherwise inspired with a higher light, have written upon the divine doctrine. But in proportion as any one endeavours to become acquainted with this invaluable collection of writings, a whole world of knowledge is opened to him. Where can we anywhere find such a clear picture of the earliest conditions of the human race as there? What examples of wisdom and justice for our imitation, and what instances of folly and injustice set up as a warning to us! What exalted images of the greatness of God, and what excellent proverbs of wisdom, are contained in this book! What a variety in style and in manner of communication! Who could read this, and increase his know-

ledge of divine things, without at the same time developing the powers of his mind? On this account, I cannot help believing that it was intended by Divine Wisdom, that all the talents of man should be developed through religion. Indeed, it even appears that this is the stipulation for the extension of the kingdom of God upon earth; for we may with justice call this kingdom *a kingdom of reason*, if we use the words with their right signification, and if we do not confound that reason which is the light of God, with the meaning which is attached to it by the frequently uncertain wisdom of the world.

The same must necessarily be deduced, not merely from the nature of the thing, but from the whole government of God, which is revealed in the distribution of Christianity. Although those who first became Christians were for the most part poor, simple men, for whose deliverance the divine Author of our religion laboured with such diligence, yet the period when the apostles and their first disciples endeavoured to spread Christianity was not wholly barbarous. It was not addressed to a nation of ignorant barbarians; it was to make its entrance into a world of refinement, among men, such as the Greeks and Romans, who were accustomed to reason, and among whom opponents soon arose, who must be combated with reasonable arguments.

And it was not long before the sectarian spirit of the Greeks occasioned disputes about opinions, so that the Christian who had any capacity for inquiry was constantly required to study the Holy Scriptures.

Though the great precept, "Search the Scriptures," has been often abused, and has been employed by some to their own detriment, yet this wide-spread study of the principles of religion, which has no equal in any other religion, has powerfully contributed to maintain a spiritual life among Christians, and undoubtedly also possesses its great significance in the government of God, in which Christianity has maintained and developed itself. If we were merely to judge by a superficial observation, we might be induced to believe that this mode of development could not have been the intention of Providence; that, indeed, it would have been far more salutary, if the communication of Christianity had not passed through such a perverted and corrupted race, by which it soon degenerated so greatly, that in many respects

it became not unlike heathenism ; but since Christianity was most needed by those people who were in the lowest state of degradation, its doctrine, perhaps, found a readier acceptance, even in its less perfect condition, among the uneducated mass of mankind, who were called upon by Christianity to become ennobled and blessed. It appears, as I have already said from this place, on another occasion, that among the laws which have been laid down in life by Eternal Wisdom, this one also exists, that where corruption of dispositions and of morals has gained the upper hand in a nation, it can only be remedied by a cruel destruction of everything that exists, in order that a new creation may spring from the chaos of wild forces.

But when such a revolution impended over an empire which considered itself superior to all the others on the globe, and which might call itself, in many respects, the protector of science, of what incalculable benefit must it not have been to the human race, that Christianity not alone contained the most excellent precepts, but also an unfading germ for intellectual improvement ! While hitherto everything of this sort had been lost in the rude hands of the Asiatic hordes, the sacred precepts of Christianity were willingly accepted. If they were not perfectly understood, they still were sufficiently comprehended for their divine nature to be felt, and for the sacred books to be regarded with respect.

Piety inspired those who were desirous of learning, with a wish to read these books, but they could not do this without, at the same time, learning much besides, and without, in many other respects, forming their understanding. Thus, reverence to Christianity, and the desire to have teachers in it, urged the barbarians to cultivate their knowledge and to adorn their minds. The cells of the monastery formed a refuge for science during the whole of the middle ages. Let it not be said that Christianity sometimes served as a veil, by which presumptuous book-worms sought to oppress the men of science who detected their errors, since it is sufficiently well known that at all times there have been men, who by their arrogance and vanity, under the pretence of zeal for the honour of God, and anxiety for the salvation of their souls, have persecuted both truth and science. But if such people find no opportunity of abusing the name of God, they are still sure of finding something to abuse, whether it may

be the name of the king, or the people, or morals, or whatever they can bring into the service of their own unreasonable desires. The injury which such an abuse has produced, is still only to be regarded as small, in comparison with the benefit which the human race owes to Christianity, even if it is only considered as a means of civilization.

How much Christianity has promoted the study of languages, is manifest to every one. What would have induced the inhabitants of Europe to study the Hebrew language, which is so remote from their own, had they not been led to it by the books of the Old Testament? And was not the New Testament the first incitement to the study of the Greek language in the West? Would the Latin language have been so familiarly known in Europe, if it had not reached us through Christianity, and grown up along with it in the writings of so many of its teachers? In an assembly of this sort, I have no fears that any one will argue that what I have laid so much stress upon is only a trifle, and that in place of valuing its possession, we would rather exchange it for something better. I am aware that such opinions are occasionally heard among the learned, and perhaps exaggerated demands on the part of those learned in languages have sometimes given sufficient cause for opposition. But he who has to a certain extent made himself conversant with languages and science, must perceive that language is not merely a means to express our thoughts, but that it is a means to awaken thoughts, in order to reveal to us the workings of the human mind, that it may penetrate more deeply into the history of the human race, where language is spread over language, and its successive layers speak to the inquirer, as the strata of the earth disclose the formation of the globe, and relate the history of times prior to the existence of man. If we wish to understand thoroughly the value of the study of languages, we must not stop at the consideration how far individuals among us might advance without these learned studies, but we should rather consider what would have become of the civilization of all mankind, if it had taken a different direction. Language appears to be the first means of civilization, not alone to individual man, but to the whole human race.

But how much our present languages owe to the ancient, not so much on account of the words we have derived from

them, of which, however, many, and certainly most important ones, have become indispensable to us, but much more by the inducement which these languages have given us to cultivate and enrich those of the present day, and to give them that flexibility which many have now attained. Even the familiarity with foreign languages of a modern date which is possessed by men of the present day, which leads to such cultivation, and to so many corrections in language, we principally owe to the knowledge that we have acquired from our youth upwards in the ancient languages, from which so many of those of our own day are derived, and to our early practice in the study of all languages.

Perhaps I shall be told, that the teachers of Christianity were for a long time unfavourably disposed to natural science, and considered it as witchcraft and the work of the devil. I might perhaps be satisfied to throw the blame of this on the darkness of those times, which only slowly retired before the light of Christianity; but I believe, in truth, that this opposition is more closely connected with the history of Christianity. It was not so much because Christian Europe was principally to receive Chemistry, Medicine, Astronomy, and Algebra, the great assistant to Natural Science, from Mahometan Arabians, but because these sciences were mixed up with dangerous error. The turn which the natural sciences of these times had taken with most people, the thirst for gold which alchemy had encouraged, the arrogant intrusion into the counsels of the Almighty, which were supported by Astrology, the abuse of various secrets of nature by crimes, could not but be condemned by the Christians. In addition to this, the knowledge of Christianity, even at that time, was not so pure. It was not yet understood how to distinguish between what was either added or misunderstood by man, and what was divine and of essential importance; so that people feared that Christianity itself would be endangered, if Natural Science exposed the falsehood of certain opinions of the priesthood.

On the other side, the study of philosophy was so constituted, that it was feared that natural science, if it had obtained a certain solidity in such times, would have received a character of crudity and materialism which it has since not entirely escaped.

Imbued with the conviction of a higher government of the

world, I can easily believe that it were as undesirable that natural science should have become the prevailing science of those times, as I feel convinced that it has been a happiness that it became the science of our own time, both because it can worthily satisfy a mature desire for knowledge, and because it forms a powerful barrier to the effeminate enthusiasm into which the finite satiety of a one-sided education is so apt to fall.

Perhaps I shall first be shown the opposition which many believe to exist between Christianity and enlightenment, and the opponent, will according to his mode of thought, find in enlightenment a proof against Christianity, or in Christianity a proof against enlightenment. In consequence of the limited powers of the human mind, truths often seem opposed to each other, and each therefore selects, according to his opinion, what appears to him most evident, in order to employ it against the other; but in most cases the opposition which is supposed to exist between Christianity and enlightenment, only refers to those opinions of men which were given out as Christianity; or thoughtless licentiousness, which people wished to consider enlightenment.

We hear it so boldly asserted that the eighteenth century is distinguished both by its enlightenment and by its want of proper appreciation of Christianity, that if assurances were proofs, we should receive it as an undoubted fact; but if we consider that most of these charges are in part directed against the priestly array of the Catholic Church, partly against their human ordinances, and do not in other respects refer to the true interpretation of the Scriptures, we shall be compelled to be cautious in our judgment. If the bold enquirers of the eighteenth century have frequently been led astray, which in many cases is inexcusable, still we must also confess that they have removed many errors. When I hear certain proud and hard men of our time condemn those reasoners, in the name of Christianity I would ask them whether they are certain in what manner the eternal Father will weigh the errors of these men against that which caused them to err; their weaknesses against their honest endeavours.

I have hitherto only represented the connection that subsists between the flourishing condition of general enlighten-

ment, and the form and mode of communication of Christianity; but this is not sufficient. We must also convince ourselves that this connection is deeply founded in the nature of the thing. Christianity aims at the highest possible improvement of the human race; it desires one kingdom of God upon earth, one shepherd and one fold. It desires to guide man to the attainment of this aim. But man is full of passions and desires which lead him wrong: if his understanding is darkened, it cannot bring him back into the right path. It is certainly true, that the precepts of Christ are so comprehensible that a child may understand them, and whoever accepts them in honest faith and honest self-devotion, and makes them the essence of his life, is immediately elevated above the cloud which obscures the sight of most men. But does not experience show us that man is so blind to the good, that few will sacrifice the gratification of low, earthly passions, either for the inexhaustible love of Christ, or for the heavenly crown which shines at the end of our course. How much that excellent as well as distinct precept, "Revenge not yourselves," is made a mockery by the deeds of men; since in many cases he who does not revenge himself is considered as wanting in honour! and have we yet been able to free ourselves from this prejudice? Is it not part of the progress of enlightenment, that this wild passion which Christ condemns, becomes more and more bridled, and that the divine wisdom which is contained in this precept is felt in still greater force? I have not cited this example as a proof, but merely to call attention to the subject; for I do not believe that it is necessary to prove here, that the wild passions which Christianity admonishes us to restrain, are subdued by that enlightenment which guides to a reasonable end the same mental powers which otherwise would riot in passion.

Christianity teaches us to regard earthly goods as small and contemptible in comparison with heavenly. No one will venture to deny this truth, and even the uncultivated man is not wholly beyond its influence; but from the daily habit of seeing nothing but what most nearly surrounds him, the forcible impression of it is with him extinguished; he is like the man who looked at his face in the glass, but afterwards went away and forgot how he looked: only the nearest

things appear to him great and important. Enlightenment also extends his view over earthly things, and accustoms him to perceive the insignificance and unimportance of what surrounds him in comparison with the events of this world. It no longer requires such a great mental leap to regard these also as nothing, in comparison with divine things. How much stronger must this feeling be with him, whom a still greater progress has brought to that point, that he can behold with distinctness the infinite perishableness of the whole material world, in which nothing is eternal except Reason, and the creative power revealed in it! Christianity requires humility, but who can regard himself as great, when the vast mirror of the world shows our littleness? Who must not feel his spiritual poverty, when he visibly traces the infinitely rich Spirit which is revealed in nature? Perhaps it will be said that philosophers are but too rarely imbued with this doctrine, and I willingly confess that they as often forget the saying of philosophy, "Know thyself," as the priests of Christ do the other, "My kingdom is not of this world." Man is slow in learning what humbles his pride; but if the kingdom of God is to be more and more spread upon earth, the human race must undergo a long training. Christ is our great master, but he will not compel us; he desires that, led by his Spirit, we should ourselves develop our powers. That kingdom of God which ought to reign upon earth, is a living acknowledgment of the will of God, that is, of divine reason; of which our human reason is an image, although only an infinitely feeble one. Enlightenment is essentially requisite for this, but not as a foreign aid which comes to Christianity from without, but as a development of the capacities of men which is promoted and urged forward by Christianity itself, and by that government of God which is revealed in the distribution of Christianity. It is therefore a deep and just feeling, which has caused the great schemes of science throughout Europe to be regarded as in connection with Religion, to whose extension the endeavours of men of science will always revert, although in the midst of earthly objects they may appear to move free and unconcerned about heavenly things.

In this sense the annual festival at the University, which

we solemnize to-day, may be united, humbly indeed, though not unsuitably, with the great Christian festival; but in such a manner that what I have to say may be regarded as a separate speech, in which my words will be presented short and without ornament, not to elevate the great festival, but to complete the day's work.

OBSERVATIONS ON THE HISTORY OF CHEMISTRY.

A LECTURE.

WHEN, at the commencement of the Winter Course of 1805 and 1806, I had to deliver some Lectures on Chemistry, to an audience among whom there were few connoisseurs, I gave a general survey of the latest changes in Science in the two first lectures; and, in a third, I endeavoured to destroy some prejudices which might prove an obstacle to me. This last lecture I afterwards put on paper, to enable me to offer it to the public. It is printed in the papers of the Scandinavian Society, for 1809, and a German translation has appeared in Gehlen's Journal for Chemistry and Physic, vol. iii, Berlin, 1807. This lecture, delivered more than forty-four years ago, bears a strong character of youth, which, however, I had no desire to obliterate. I have, in general, made no improvements, except by the omission of a few passages, which was necessary for the sake of accuracy, as it would have otherwise caused confusion in the minds of most readers. Once I replaced the omission by a short representation of its sense. In a few passages I have inserted some short remarks, but these may be distinguished, as they are inclosed within brackets.

The various Changes in Chemistry.

It is an old complaint, and has been often repeated, that there is a want of unanimity in the kingdom of science. Exactly where we might expect uninterrupted peace, and a unanimous endeavour towards one object, a perpetual war is established by constant changing revolutions. Who does not know how many opportunities this disagreement has afforded for the distrust of the timid, the laughter of the scorner, and for declamations on the uncertainty of human knowledge to the enemies of science?

What I mentioned in my last lecture with respect to the

antiphlogistic theory (namely, as one embracing all the chemical phenomena together,)* must again give rise to the same complaint. We shall once more present a new theory, in exchange for one that was made but a few years ago with the approbation of nearly all the enlightened world, and which was not, indeed, established without a hard struggle, in which the grounds on both sides were frequently weighed and re-examined. Nor was it in the world of ideas, where Reason might perhaps, have stumbled in its own immeasurable depths, that this struggle was carried on; but within a circle where all was brought before the old and sure test of experience, by which, therefore, everything attained a much greater degree of certainty. This is the theory which must be renounced. As this system falls to pieces, so have many, in every science, and they have often been forced to yield to others entirely opposed to them. Where is the limit to these changes?

Is it probable that we now possess the true theory, which can stand unshaken against all the attacks of future times? We have no more probability for this than our predecessors had for the correctness of their ideas, which they held to be as true and certain as we now hold ours to be. We therefore must consider it possible that we may equally err. On this account many experienced men have rejected all theories, and considered them as beneath their notice. They ask whether it is probable, or whether it can be more than a pleasing dream, that reason should ever reach that unanimity which in the efforts of so many centuries, and the meditations of so many great minds, it has not hitherto attained. If we follow their views, then there would only exist one truth, the Reality which has surrounded us firmly and constantly amidst so many changes, and which every moment extorts fresh evidence from our senses. Theories might perhaps enable us to separate our knowledge into certain groups, where we may more easily find it again; they might, perhaps, be of some use in exercising that acuteness of youth, which is to be employed in a practical career; but that so many contradic-

* It has not escaped my notice, that the antiphlogistic theory is often mentioned as if it were unrefuted, and in a certain sense this is correct, so far as the circle of experiences is only alluded to, which it embraced, and whose harmonious connection it exhibited; but it no longer exists as a complete chemical theory, as every one will now readily grant.

tions should ever contain one unity and truth, or furnish an actual insight, can in no wise be admitted.

A more noble but weaker nature justly adds to this a painful consideration. The whole value of man lies in Reason: if the greatest efforts which it has made have only produced a mere vision, then man is the most imperfect and unhappy of all creatures, for he has abused the faculties which were bestowed on him by nature for his preservation, and has by that means sought to tear himself away from the reality, of which, nevertheless, he only forms a part; a revolt which, carried out in all possible directions, is however punished by Nature with perpetual restlessness, and innumerable weaknesses unknown to other creatures. All are drawn into an unhappy vortex of follies, but he who perceives it is doubly unhappy, for he cannot resist it; he is only one among his race, which for thousands of years has laboured to withdraw him from Nature. Even suppose that he felt sufficient strength to approach it on the one side, he is yet compelled to tear himself from it on the other. Thus man hastens with increasing velocity towards his downfall; and, even should this be the fate of the whole globe, over which, in his savage state, he has made himself master, still he alone has the misfortune to foresee it.

The rash youth pursues another path; he boldly cuts the knot. He truly says that cowardice leads to despair. Who taught you that truth, the greatest of all treasures, was to be gained without an effort? Are you accustomed to count the voices, that you may know what is right? Will you not then be obliged to pronounce the majority unwise? Transfer this rule to these who pretend to be philosophers. If there have been controverted opinions, one of them nevertheless must have been the correct one. Can you wonder that these opinions have altered, since all have not striven with equal zeal, with equal force, with equal love of truth, after the great end in view? Besides, if the truth has not been discovered, it still may be discovered; there is, indeed, a whole eternity still before us. The power which tore you away from that which you call the reality, must surely be stronger than this reality itself. It can, it must lead us one day into the kingdom of truth, and even the endeavour to reach this is glorious; our powers are exercised, our intellectual life is preserved, our mind tranquillized by the cheering prospect

that our whole race is in progress to something higher, to something better. Is not this a sufficient reward for the small labour we undergo? Thus, while we strive after unanimity, a new struggle arises, and we gladly pursue it, with the joyful prospect of future repose. We soon, however, remark, that man has but just commenced to wander in the path of science. He views himself only as a rational being, and he is right; but if he looks back on his individuality, and its accompanying restrictions—if he remembers the host of reflecting men who have fallen into error—if, weary with the battle of life, he reflects for a moment, Those men were as convinced as you, yet they erred; are you stronger? Might you not, perhaps, also have been involved in error without your previous knowledge? he will then, ere long, not indeed mistrust reason, but himself. He will be compelled to extend this doubt to all other human individuals, and consequently to his whole species, and we see him now at the same spot from which his despair originated.

But I see those who have been distinguished in the history of the human mind, quietly looking down on this confusion. They say to us, "We have sacrificed more time and greater powers than our brethren, to fathom the depths of nature and of reason. We only encountered obscurity and doubt, part of the way; the deeper we penetrated, all became light and unity before us. Each of us has learned from his predecessors; and has been the teacher of his successors, not merely by collecting a much greater amount of knowledge, but also by a deeper search into the order of things. And have we not confirmed our truthfulness by this;—that we have transmitted to you laws by which you may perceive and calculate much which no eye had previously beheld. Give us a proof for your incredulity! Do not allow yourself to be deluded by the semblance of disagreement. The period of time, the country, the character of each man, has borne with it its particular tendency, and has given his works their peculiar stamp. We are all, however, united by a secret bond. Search zealously the history of the sciences, and you will there meet with repose where before you only found doubt and discontent."

We will follow this voice, for it is the voice of truth. By a closer consideration of this struggle, which has disturbed our repose, we shall discover the purest harmony, the most

complete rest and certainty. In fact, it would indeed be an object worthy of the reflecting man, ~~to search for that inner unity in all the sciences;~~ but a task of such extent would lead us now too far from our object. We must be content to pursue the course of the development of the one single science for whose explanation these lectures are intended.

As the history of every science seems only to offer to the superficial eye a chaos of contradictions, and a torrent of conflicting forces, it is thus also with the history of chemistry. From the time when the scattered experience which contained the earliest germs of this science were first united into one whole, we find a constant progression and retrogression, ~~but no continued advance.~~ It was at first concealed in the middle ages by an impenetrable veil of mysticism, and we can easily imagine that, at that time, there must have been as many different opinions, as there were enthusiasts. To produce the most precious metal which is presented by nature, to discover one universal solvent, to obtain for the human race an infallible cure in every kind of disease, were the problems of science which were endeavoured to be solved in a variety of ways. Yet nearly every one was of opinion, ~~that there lay a deep-rooted resemblance, hidden from the uninitiated eye, between even the most distant objects in nature,—that this could only be discovered by a peculiar gift, and might be employed to fulfil the great end which they had set before them.~~ Thus the imaginary characters of the planets were sought for in metals, and the works of chemistry were guided by astrological combinations. The correctness of this mode of representation was the more easily believed in, as precisely the same number of planets as metals were then known. What would they now say in defence of this opinion, if a more enlightened astronomy showed them, that the sun was no planet, and the moon was a mere satellite, similar to many others which we discover by the aid of the telescope? What would they think, if they now learned to distinguish by a more skilful chemistry, nearly thirty metals, (that was the number in 1807, but now they number more than forty,) and in addition to this, if they saw the probability, bordering on certainty, that there are yet many more to be discovered? Yet who would now give himself the trouble to refute opinions which are rejected by all the rational world, although in those dark times they were

countenanced by the most profound thinkers, and found protectors in the most powerful princes. We must be content to bear in mind, that chemistry was to them ~~no more than~~ the production of the metals, and her ~~natural forces no more than~~ mystical similarities of character. This, I say, is sufficient to show how little it resembled our more comprehensive chemistry, how opposed it was to our present endeavours after a more distinct and penetrating science. But we can by no means be pacified by attempting to console ourselves with the reflection, that that great period was a night full of fantastic dreams, which is now happily past. If the men of those days were able to commit such grave errors, who will answer for us that we shall not just as much err on the opposite path, and, from a mistaken endeavour to understand things, overlook that which constitutes Essence, with its still incomprehensible existence, in the whole of Infinite Nature? Or can we venture, on historical grounds, to regard that period as one of unimportance, at a time when many highly gifted minds are once more bringing to light several of its dogmas.

We will, however, turn our eyes for a little while from this time and age, so different from our own, and not even dwell on the period of fermentation which lay between it and more modern times; that it was a period of contradiction and struggle, need not astonish us. We will direct our whole attention to that period of time when the causes of natural events were placed in conceivable natural forces, and when there was a desire to comprehend, by means of experiment, each of these events in their utmost possible purity. At this period, indeed, all acknowledge as their judge one and the same reason; we might, therefore, expect more unanimity to have existed, but no expectation can be less fulfilled. To enumerate how many opinions arose and vanished during this period, and which of these again became the prevailing one, would furnish materials for a book, and would necessarily weary the attention, even were it possible to comprise them within the narrow compass of a lecture. We will, therefore, now only turn to a few of the chief points.

The knowledge of chemistry that had been acquired had begun to be arranged; and a combustible body, called phlogiston, was imagined, which was said to be contained in all substances. Each combustible body was therefore composite. Combustion was thus decomposition. Metals were

composed of an elementary earth and phlogiston. Those bodies which by combustion yield an acid, must necessarily contain this acid as one of their constituents united with the combustible substance. Innumerable phenomena were explained by this doctrine, and it was believed that in it had been discovered the key to the secret laboratories of nature. Nevertheless, people were far from unanimous as to the nature of this combustible matter; sometimes it was held to be sulphur, sometimes a fine earth, sometimes a portion of light; and a property was at length bestowed upon it, at variance with all other bodies, namely, that it had the power of annihilating gravity.

When it was believed that this doctrine had been brought nearly to a state of perfection, it was overthrown by another, so opposed to it, that it even received its name from this opposition. By denying the existence of the combustible substance, the antiphlogistic theory altered the entire previous mode of conception. Combustion ~~was now no longer decomposition, but, on the contrary, composition—a combination with oxygen.~~ This element was held ~~to be contained~~ in acids, and it was ~~inherent to their nature to be compounds~~; whereas, the matter which yields an acid by combustion might be a simple body. The arguments for the compound nature of the metals thus failed, and they were considered elementary substances. Water, which by the former theory was an element, now became a compound. In short, everything was reversed, and one was tempted to believe that no stone of the old building would remain upon another.

Yet hardly had the struggle ended about these two systems when a new struggle arose, which began by denying that water was a compound. This doctrine has never been completed; but so much is certain, that its whole effort terminates in an endeavour to overturn the antiphlogistic doctrine, which seemed to be so firmly established. Indeed, it even goes beyond this, since it seeks to establish entirely new points of vision for the whole of chemistry, by which nothing of that which we have hitherto called composition and separation, shall be considered so in future. All that we had hitherto learned of chemical affinity, that which the phlogicians and antiphlogicians had agreed in common, is now to be considered as invalid.

Although this view has not been maintained, still it

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remains certain that the discoveries of electro-chemistry have altered the views of chemical effects in an important manner.

Every theory in Science prevailing throughout a certain period, contains actual Scientific Truth, though frequently much obscured.

We will now attempt to throw some light on the chaos, which at first sight exhibits nothing but a crude mixture of the remains of so many periods of time. However, to facilitate your view I will determine beforehand the course of the research which I think of laying before you. I will, namely, first show you that all those who have had some insight into science, whatever theory they may have embraced, have yet been in possession of a great and profound truth. It will at once be evident by this research that the course of this science has been an actual development. I hope, further, to be able to point out to you that this development has followed necessary laws. A nearer consideration will finally, convince us of the beneficial nature of these laws.

I am quite aware of the discursive nature of the research into which I have led you, and I am also willing to confess that in the short space of a verbal lecture it cannot be carried to any considerable degree of perfection; but I yet think that I may be able so to touch on the principal points, that each of you may yourselves be enabled to make an extensive application of it.

The mystical tendency of the middle ages is so opposed to our present efforts in pursuit of perfect clearness, that it might easily appear impossible that they could both form constituents of one truth. To deny their antithesis would be opposed to manifest truth; but yet there is no antithesis which ~~has not something in common~~. Perhaps the strongest antithesis might have its foundation in the one-sidedness of both periods, and they might, on the other hand, show themselves to agree in much where we had not suspected it. Each endeavour after an insight into nature tends to bring the separated phenomena under common points of view; to ~~discover the laws by which all must be guided;—in short, to bring a unity of reason into nature.~~ This endeavour, at least, was common both to the mystic period and to our own.

Amidst the errors of alchemy, the one which appeared most strongly was, that metals bore an analogy with the planets. It would be folly to deny that this idea led to opinions and labours utterly opposed to nature; but yet it is not impossible that it contained a feeble anticipation of truth. We now have grounds to assume that the whole solar system is produced in accordance with intimately connected laws, and that the heavenly bodies, the sun, the planets, the moon, and comets, are, as it were, resting-points in this development; it is not now impossible that the metals, and other substances allied to them, might be similar resting-points in the development of the earth, and that there might exist a similarity in the laws by which both developments have taken place. Yet we will not conceal from ourselves that we here build suppositions on suppositions, and that we do not lay much weight on this supposed possibility.

But even without referring to this, that former period has been beneficial to science. Not to mention the number of separate discoveries which we owe to science, it has also given us different connected series of allied matter; for instance, mineral acids, as well as the commencement of our knowledge of alkalinity. The so-called oxidation of the metals, and the different modes by which it is usually treated, were likewise discovered by the chemists of that period. They even contributed something to the chemical knowledge of the atmosphere, since they showed that there exist some kinds of gas different from those which surround our earth.

We accordingly see that the mystic period did not act without a plan and without result. We may still more easily be led to this conviction by the phlogistic period. It is, indeed, true that the founder and the adherents to this theory explained everything from one element, whose existence they assumed though they could not prove it; but yet their ideas of the nature of combustion were not so absolutely mistaken as might have been supposed from the falsity of such a pre-supposition. The thought that combustion was the central point of all chemical effects, betrayed an unusually profound view into nature; for to embrace such a thought it was not sufficient to regard with attention the origin of fire and the brilliance of flame, it was also necessary to perceive that nature often produces effects similar to combustion by other means than fire, and to discover that there was never-

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theless one force in common, in all these apparently different effects. It requires a very discriminating and bold spirit to discover combustion where no flame, frequently not even warmth, proclaims its existence. And to distinguish combustion even in the midst of a fluid body, or, what is still more, to discover a decided similarity between the breath and flame, demands indeed a preparation of centuries.

After such a great and yet deeply penetrating view, it was first possible to arrange bodies in a series according to their combustibility, for it was now known in what combustibility consisted. By means of this series, the natural law was determined that the more combustible, when in a state of combustion, can restore the less combustible to its first condition. It was also perceived that a body lost its combustibility in the same degree as it became burnt; and thus that great law was determined, which is as widely comprehensive as simple to be understood, that combustion and reduction are two antagonistic processes which pervade the whole of nature. Such great ideas, the fruit produced by the efforts of a century, are comprised in these few words. But whoever is acquainted with nature, knows what these words signify. I wish that you may form a clear idea of them to yourselves. Who does not know the part that the metals play in the history of the human race? They perform a no less important part in the history of the earth. They are contained in stones and crystals, they penetrate mountains, they form the basis of enormous masses, and they appear everywhere in the most variable forms. Nevertheless the theory of combustion embraces them in a nearly unlimited universality. To whom is it not evident that the circulation of the blood is the chief spring of animated nature? Who does not know that respiration is one of the elements in that great chain of effects? But has not the phlogistic doctrine adopted this? Why bring forward so many examples? None of you are entirely ignorant of the phlogistic doctrine; you will therefore yourselves discover them in abundance.

We shall not be inclined to reproach Stahl and his successors, because they assumed a common principle to exist in all combustible materials. The antiphlogicians themselves assume this, while they attribute to all combustible bodies a chemical attraction to oxygen. The error of the phlogicians can therefore only consist in this, that they

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assumed a material basis of combustion ; in which assuredly they were wrong. But we must consider that adherence to the material formed the character of the period in which they lived, ~~from which only very few chemists of the present day have disengaged themselves.~~ Phlogiston remained nothing but a cipher, an X by which they denoted the unknown basis of combustion. Even should they have added something to this sign, by which it has lost some of its purity, we must yet confess that within certain limits we might calculate by it with precision. Besides, we are far removed from considering the doctrine of combustion as the completion of the science: we only consider ourselves justified to assert, that it contained a correct and enlarged view, a perception of a great law of nature. But the perfect clearness even of this perception is obscured by each arbitrary assumption. There always exists a certain point where such an assumption essentially interferes, and from this point, errors are distributed over everything else. Such is also the case in the phlogistic doctrine. Hypothesis blinded them to that which nature revealed. Hence they overlooked the real action of the atmosphere in combustion.

It was reserved for Lavoisier to discover this, and to found a new system, which was given out as more original than in fact it was: for the fundamental idea of the earlier system was also the basis of the new, and could not possibly be rejected: but that combustion is a composition, and not a separation, that all bodies in combustion receive oxygen, that this oxygen constitutes a common constituent of many acids, are some of the peculiarities of the antiphlogistic system. The naturalist by these discoveries is first enabled to specify, and to calculate beforehand, not only superficially, but with the greatest nicety, the products of the various effects which we must now range in the class of combustions. The antiphlogistic doctrine was, however, first completed by the discovery of the constituents of water. That the most combustible of all substances exists in water, combined with that which is the condition of all combustion, is a discovery of whose importance no one can doubt, who for a moment recalls to his remembrance the variety of bodies which either the elements of water receive separately in order to unite, or united in order to separate. What an infinite number is thus offered to our contemplation!

You easily perceive that the antiphlogistic system, in spite of its name, is still a continuation of the phlogistic. That they are opposed to one another, proves nothing to the contrary, for you have yourselves seen that it was only in one point, and not in all. We therefore easily made the transition from the one to the other.

The system which proceeds from the latest experiments pursues a path which differs still more widely from that last mentioned. It even originates from a research into an entirely different province. It was from the researches into electricity, that a new light was thrown on chemistry. The power which already in ancient times was discovered in amber, after it had been submitted to friction, was by degrees observed to exist in many other bodies, and at length the knowledge was arrived at, that it must exist in all natural bodies. The fundamental laws of this power were discovered by the deep researches of Franklin. Nearly all the older instruments for the investigation of electricity were improved, and now that we were guided by fixed principles, a number of new ones were discovered. Electricity was detected where formerly it was hardly supposed to exist, and at length it was found, in various ways, that this power was excited even when bodies came into contact with one another. We gratefully remember the services of Volta in this respect. It was at the same time discovered that the contact of bodies altered their chemical forces, and Ritter's prophetic glance already discerned in these experiments the connection between electricity and chemistry. Volta went still farther, and found that a combination of several parts produced an increased action, and now it was generally admitted that a power of chemical action existed in electricity. Although most people continued to view it only as a one-sided chemical means of action, not as the exponent of a universal force in nature, yet all did not limit their views to a mere name. Ritter showed that the chemical changes in water depended on an electric distribution of force, and consequently viewed the whole doctrine of the composition of water from another side. But not alone the doctrine of the composition of water, but the whole chemical theory received a new direction by this change. It has been shown by various discoveries, whose completion we owe to Ritter, that all bodies having the property to evolve electricity, constitute a series.

very of arrangement

The first member in this series, placed in reciprocal relation with other bodies, produces positive electricity; the second receives indeed negative electricity with the first, but positive with all the remainder; and so on to the last, which receives negative electricity with all other bodies. Among those bodies, which taken as a whole, stand in the same relation, we find that this series runs parallel with combustibility; so that the positive are at once the most combustible, the negative, on the contrary, the least combustible bodies.

The so-called decomposition of water is an electric charge of this description, in which the only remarkable circumstance is, that the inequalities produced are so great, and that they are distinctly visible to our eyes. The positive pole of water is the hydrogen, its negative pole the oxygen. United, they again remove the opposite forces, and form water. Water is that body in which the great equilibrium of all forces takes place; hydrogen is the most combustible of all bodies, oxygen the least combustible, and itself the condition of all combustion.

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what, of no action with positive*

Thus a new theory of combustion is presented to us. The combustion of hydrogen is only a union of the positive which it contained, with the negative of the oxygen. Flame is really an uninterruptedly renewed electric spark, or speaking more correctly, light and warmth are produced because these effects have the same elementary actions as electricity. But that which belongs to the combustion of hydrogen equally belongs to every combustion, since every combustible body is combustible by the positive which it contains, and burns when this becomes united with the negative. In this manner we assume with the phlogicians an inner principle of combustion, and with the antiphlogicians an outer one; but we differ from them so far that we do not accept these as material.

*the same substance
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potency*

We must necessarily feel in this, that our whole mode of representation sustains an essential alteration. Formerly we everywhere assumed actual combinations and separations where two different bodies become united into one; but we now assume, on the contrary, that one distribution of force equalizes them both. This does not belong only to combustion, but also to the reciprocal effect between acids and alkalis. We shall merely notice in the course of this lecture, that acidity and alkalinity depend upon a certain form of

existence of the two fundamental forces which have been frequently mentioned, and that thus those various natural events which chemists ascribe to neutralizations, may be also viewed as indifferences.

[That composed bodies were mere conditions of polarization of one element, was a view which I soon abandoned; but it is easy to perceive that the inner connexion of the electro-chemical view which has been offered is not thence disturbed. Some propositions are also here presented with too great a tendency to universality; but when this is rectified, the principal view remains correct, as is now sufficiently recognized.]

It cannot have escaped your attention, in all these considerations, that the point of view for all natural events is certainly changed, but yet that the connexion which had at one time been found between great series of natural events, will not be destroyed in order to form a new one. That combustibility not merely consists in yielding flames under certain circumstances, that combustion has its antithesis in another process, which we call reduction; that a reciprocal action between oxygen (or any other negative body) and the combustible body belongs to combustion; that water can be turned into hydrogen and oxygen, as these again into water; continue to remain discoveries of the greatest importance, which we all employ, but which we at the same time bring under the necessity of a higher law.

That there is a true course of development in the theories which have followed one another, and which have been successively solved.

The most difficult task in our undertaking, namely, to exhibit an eternal truth in the variety of contradictions which are offered by the history of science to the unpractised eye, is now, I hope, carried out as far as our limited time permits. The same research places clearly before our eyes, that the course of science has been a development, and an actual progress. But I will add a few remarks with reference to this.

Science has gradually gained, not merely by theory having attained a greater perfection, but also with respect to the extent which it embraces. In the middle ages, no other

chemistry was known than that of metals, and this is very natural, because these bodies, after they have undergone the most various changes in their aspects, most easily resume their previous form, so that we first receive from them a connected experience.

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The phlogistic theory already embraced a far larger number of objects within its limits; such as fermentation, respiration, fire, &c. Although the chemistry of the middle ages touched on all these subjects, it yet never truly assimilated them into its mass. The antiphlogistic theory does not embrace so much more than the phlogistic, yet it cannot be denied that it was the first to accept the doctrine of the gases as one of its fundamental constituents. The new theory, which we might name the dynamic, enlarges, on the other hand, the extent of chemistry far beyond its former limits. Electricity, magnetism, and galvanism now also belong to chemistry, as it appears that the very same fundamental forces which produce this effect, produce chemical effects in another form. We have found that electricity, particularly in that form in which it appears in galvanism, ~~is able to produce the extremes of all sensational perceptions:~~ in the organ of taste, acidity, and alkalinity; a similar contrast in the organ of smell; to the eye, the two most extreme prismatic colours; the higher and the deeper tones to the ear; in the feelings, an alternation of heat and enlargement or contraction; in the nerves, altered irritability. The same effects are produced, by different matters, in relation to ~~the fundamental power which reigns~~ in them. Thus the doctrine of the perceptions of the senses may be drawn into experimental physics.

However much chemistry has extended its boundaries, it has gained no less in inward connexion and solidity. The so-called chemical affinities or attractions, the *qualitates occultae*, on which combustion, as well as all the other chemical effects, depended, now resolve themselves into forces, to which we are able to give free play by experiment, and thence to obtain some knowledge of them. The antithesis between the process of combustion and the process of reduction, now becomes far more comprehensible, while we perceive that they depend on a preponderance of two opposite forces. That which we before named neutralization, is no longer a secret to us, as we know that it depends on the equilibrium of exactly these opposite forces, only under a different form.

I feel that while speaking so much of the recent progress that has been made, I have rather to fear your distrust, than your failure in attention from the apparent insignificance of the subject. I hope, however, that you will keep in view, that every great epoch in history has been marked by discoveries which, to the eye which is dazzled by novelty, appear to swallow up all the preceding ones. I may also venture to suppose that it has not escaped your attention, that science must advance with continually increasing velocity, if there is no external interruption; for who is not aware that with each new discovery the means to make others are augmented—that with the rise of science, the number of its promoters increases, and thence their zeal is heightened? If this assertion of the growth of science required more explanation, it might easily be found, even by a mere superficial view of the history of science. The heaviest, hardest, and most unchanging of all bodies, if I may so express myself, the most material matter, was the first object of its research. The phlogistic theory still clung to the solid mass; yet it assumed the existence of a fine substance, which many believed was imperceptible to our senses.

I hope that these few observations will be sufficient to convince you that the *changes* in chemistry did not consist in a floating hither or thither without an object between two opposite points; but that ~~its history is a true development from its first germ to a perfect organization, which continues daily to push out new branches, and will not cease to bear new fruit, so long as inexhaustible nature, in which it is rooted, supplies it with fresh sap for its nourishment.~~

The Development of Science obeys certain Laws.

That this course of development was not ordered by chance, but that it followed necessary laws, is already proved in the former part of our investigation. I may, therefore, be so much the more brief in the development of this subject. It belongs wholly to the nature of the case that one piece of knowledge always contains the germ of another, which must be sufficient to cause philosophers to admit that the course of development is guided by necessary laws; but as we are now anxious to meet doubts which are caused by an uncertain

experience, we must submit the different parts to a more narrow investigation, that allows a more complete experience to destroy the terrifying dreams caused by imperfect knowledge.

Chemistry has grown up on the foundation of experience. Innumerable chemical phenomena surrounded mankind, under such varied forms, that even the most acute eye could not at once discover the inner connection; a similarity began to be discovered between some of these phenomena and between certain bodies which had much in common with one another. But to unite under one point of view all chemical natural events, such as the dissolution of salt, fermentation, combustion, the oxidation of metals, respiration,—different as they are from one another,—has been alone rendered possible by innumerable experiments, collected in a course of centuries. It was naturally first necessary to discover fixed laws in the bodies which were least disturbed by chemical forces. This property is possessed by metals. They indeed alter their form when submitted to those means of action which with more or less violence, are able to cause combustion; but they also very easily regain their former lustre and connection, and once more issue from their ashes. It is therefore natural that the first trace of a chemical theory developed itself from metals. To produce metals, and especially the most precious among them, was then the great problem of chemistry. To decompose these heretofore indestructible bodies was necessarily most intimately connected with this. If this problem had really been solved, then free action would have been given to the most secret forces of nature, and we should have also possessed a means to withstand all disease. We must confess there was a full appreciation of the end towards which their efforts must necessarily tend, if they were to reach fulfilment.

If they did not immediately obtain a philosophically clear consciousness of all that was requisite to reach the great end they had set to this science, namely, to become acquainted with all the rest of nature, they yet felt the necessity to include innumerable non-metallic substances in their research. In this manner they gradually laid the foundation for the extension of chemistry, and ended with the knowledge that the combinations and separations of all bodies were objects of the same science as that of metals. They were especially obliged to endeavour more and more to discover the laws by which metals, under certain circumstances, lose their

of chemistry

extension

lustre and their metallic nature, and under others again recover them; that is, they were compelled at last, in their experiments on metals, to find a portion of the theory of combustion. It was in this way also that the phlogistic theory, of whose merits I think I have given you a distinct idea, was actually discovered.

In order to distinguish between different gases, still more is required than to distinguish between two metals or other solid bodies; for neither by the eye, nor by the sense of touch, and rarely even by smell, can we detect any inequality between them. They could not, therefore, be distinguished directly through the senses, but only by observing their relation to other bodies. Independent of this, much more was requisite for their treatment; and their weight and measurement especially, implied not only the knowledge of many other things, but also the employment of the finest instruments. A thorough knowledge of the gases was therefore only the fruit of long inquiry, and could not appear in the earlier periods of the science. But the whole antiphlogistic theory is, indeed, founded on the doctrine of the gases: it therefore could not have been discovered without them; not, at least, systematically carried out and completed; and just as little could it have been omitted, if the gases had been accurately known. The more various are the bodies which we know, so much the more skilfully shall we understand how to imitate the events of nature, and learn to refer them to one unity, and the less shall we be satisfied with mere appearances. To penetrate to the inmost part of bodies, to discover the most simple forces of nature, must therefore be a work of the ripest age of science. It is true that man, as soon as he opens his eyes, sees around him expressions of the most inward forces of nature, but they appear to him as wonders, separated from all the rest of nature. Thales could, indeed, perceive the electricity that amber emitted when rubbed, but he could not draw the conclusion that it was a universal force of nature. He must have viewed it as a force which was peculiar to this material, as most bodies do not express it without a more careful investigation, under conditions which were still unknown. As soon as the art of experimental research began to be practised with greater ardour, the same force was again found in many other bodies; yet there continued still to be a large class of bodies, in which it was

Theory of knowledge is different
and leading somewhere
Nature is not

but
nature
is
different

Non material
in chemistry

not discovered, and which were therefore considered *entirely non-electric*. It was now observed that some bodies permit electricity to pass through them with greater rapidity than others, and thus that a body might produce much electricity without showing electricity, because it does not retain it. A means was now discovered of receiving electricity through good conductors, and of checking its course by bad ones, and a method was soon acquired of strengthening electric action to a degree hitherto unknown. Franklin's genius was now first able to prove fundamentally that the different kinds of electricity were related to each other as antagonistic forces. Electrical effects could then be calculated; and thus Volta, by a series of conclusions, was enabled to discover the instrument which exhibits feeble electricities so many times strengthened, that it was possible to discover, even to estimate, the magnitude of electricity, where previously it was not supposed to exist. Now only was it possible to show with complete certainty that bodies yield electricity by contact, and that this effect is governed by fixed laws. Contact-electricity was thus confirmed, and the transition from materialistic to dynamic chemistry.

You will surely not require me to proceed in this manner from all the various points of commencement in our science, or that I should pursue all the paths which finally end in one point. Such an undertaking would now lead us too far. I anticipate, however, one very natural objection, and I must meet it. I maintain that every step in the course of science is necessarily made from the preceding one, and even renders it necessary that another should follow. Although you may perhaps agree with me that this is the natural course of things, you might at the same time argue that very considerable deviations from this course may occur, since speculation long precedes experience; and genius, by aid of feeble tracks, has been able to discover what has otherwise occupied the experience of a century. It were indeed equally possible, that chance might have early brought to light some natural events, which, on the ordinary path, would not have been discovered for many centuries. You might remind me of the discovery of galvanism, which entirely depended on a chance occurrence. But I reply, that this chance would have been without result to science, if the discoverer had not used it in the spirit of a true inquirer; and however important the disco-

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very of Galvani may have been, it would still have made but little impression at an earlier stage in the progress of chemistry. If electricity had not been then known, if it had not been understood how to arrange the metals according to their combustibility—which implies a considerable knowledge of chemistry—then the discovery of Galvani, even supposing it had been made, could only have existed as a solitary wonder, without creating a revolution in science. If Volta had not already discovered how to render perceptible feeble degrees of electricity, it could scarcely have been proved that the same fundamental force exists in electricity and in galvanism; in short, galvanism might indeed have been discovered, but it would have remained an inexplicable wonder amidst other marvels, as is partly the case at the present day, with regard to animal magnetism. Even should we grant that a man of great genius might have comprehended such a discovery, and pursued it through all the feeble tracks in which the more acute eye might distinguish its connection with the whole, it yet would not enter into the universal mass of thought. We see, for instance, very clearly, in the early writings of Ritter, that even before the discovery of the electric battery, he had meditated a new system of chemistry from galvanic elements, but he would doubtless have found great obstacles if that discovery had not facilitated his labours; and I believe, even if he had completed his intended work, which rested upon such delicate experiments, it would at the most have gained the notice of a few superior intellects, without producing great or important effects on the course of science. We see a striking proof of this in the earlier history of chemistry. Did not Mayow discover the pneumatic theory a century before Lavoisier; did he not bring forward proofs in its favour, which now seem of the greatest importance? Did he not recount his discoveries in a language which could be read by the whole of the learned world? And in spite of this, was not his theory forgotten till after the time of Lavoisier, when it was again disinterred from the dust of libraries? It remains an everlasting and glorious truth, that the man of genius, in the holy hours of inspiration, may look far beyond the narrow horizon of the period; but it is equally certain, that the higher he stands above his contemporaries, it will be the more difficult for him to draw them up to his own position.

You may easily see that I am far from wishing to deny the influence that genius sheds over a century or over a country, but I maintain that it cannot affect the whole, unless that link is produced which agrees with the previous one in the already connected chain. It was, therefore, quite as impossible that the period in which Mayow lived, could receive the pneumatic theory, as it was impossible that in the period of Lavoisier it should not have been discovered, either by him or by some other man of clear discernment. A genius who passes far beyond the appointed end, may indeed be a wonder of his age, and gain the admiration of posterity, but he plays no important part in the history of the human mind.

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If it is still required to cite an example of the harmonious regularity in the advances of science, I might mention the fact that Newton and Leibnitz discovered at one and the same time the differential and integral calculus. The doctrine of motion had reached such perfection, that this mode of calculation, which is especially adapted to express its inner mechanism, was of necessity discovered. Philosophy demanded an infinite development of time and space; mathematics had exhausted itself in finite formulas, and now two distinguished men were at the same time impelled to strive after one and the same object.

A closer view of the Law of Oscillation in the development of Science, and its beneficial influence.

But while we rejoiced and comforted ourselves with the reflection that we had found an eternal truth in science, and an inviolable law in its development, we glided from one error to an opposite one, and we discovered a source of contest in this last, which might have been avoided if we could have at once hit on the true point of equilibrium. This indeed seems at first sight to be an exception to the progress which we believed we might have placed as a law for the development of the human mind. But on a closer inspection, it would only be an argument against us, if we assumed that this development must happen in a direct line. We have, on the contrary, only assumed that there is a development, and we have left to a closer investigation the particular form in which it took place. It is natural to the

human mind, to work in alternate extensions and contractions. To investigate this more deeply would at present lead us beyond our limits; we will therefore satisfy ourselves by rendering this law more visible by experience.

The activity of our minds divides itself in two directions, to create and to form. These two cannot be wholly separated from one another, but they are rarely so amalgamated, that either the producing force or the arranging thought does not preponderate. Each person need only remember what at different times has passed within himself. It can have escaped no one who is accustomed to think, that ideas have sometimes sprung up so powerfully from the creative power within him, that he has been lost in a happy contemplation of them, far removed from the attempt to bring them to distinct forms. It is true that the ideas originated in a form, and often in the most excellent one, but frequently something estranged from the individuality has also crept into the idea, which disturbed the entire distinctness of the image; and still more frequently the stream of inspiration has extended beyond all bounds. In quiet hours, Reason, with its power of arrangement, ~~appears in complete activity, cuts away, arranges, connects, and finally exhibits the idea in its pure heavenly form.~~ Hence life, even in those most highly endowed with genius, is divided between inspiration and reflection, without whose union nothing perfect would be produced. The hours of production I now call those of extension, those of Reason the restraining ones; and there are similar periods, as I believe, in the history of science. ~~There are times, rich in discoveries, when a multitude of great geniuses step forward at once, almost as if it had been previously concerted; and science is filled with great discoveries.~~ They are received in great numbers by the clearer minds of the period, while the more limited minds are opposed to them. A quieter period now again appears, ~~when the great ideas of the previous time are explained, arranged, and determined.~~ This endeavour at first promotes the organization of the new created idea; but at length definition is carried to such a length, that it destroys all life, and it would turn science to a petrification, if genius did not again appear, which once more kindles the extinguished fire; and it seems as if it were the dread of that universal death which most powerfully stimulated the slumbering creative force. Thus, throughout all history, there

is a 'creative and an arranging, or an enlarging and a restraining force, whose law doubtless is, that the one must decrease as the other increases. They must, therefore, always be in a constant struggle and involved in war, by their violent collision.

doctrines This might, indeed, at first appear dangerous to the progress of the human mind; but does not our own corporeal life consist in a struggle of antagonistic forces? can mental life in its finite form express itself in any other manner? It is a law of material nature, that one antagonistic force always excites the other; it is the same also in spiritual nature. Every doubt, every contradiction to truth, awakens an argument in its defence, and places it in a clearer light. Even the powers which are employed by the more limited mind of the multitude to hinder the progress of science, only serve to raise those powers, which ought to be promoted to a still higher degree. It is therefore not alone the struggle which takes place between noble spirits of different times: even the lesser efforts of the evil-disposed are parts of the great chain. But we must leave these to defend themselves for having undertaken to act such an evil part.

So much is certain, that nothing is better adapted to form a mind which is capable of a great development, than living and participating in great scientific revolutions. I would therefore counsel all to whom the period they live in has not naturally presented with this advantage, to procure it artificially for themselves, by reading the writings of those periods in which the sciences have suffered great changes. To peruse the writings of the most opposite systems, and to extract their hidden truth, to answer questions raised by these opposite systems, to transfer the chief theories of the one system into the other, is an exercise which cannot be sufficiently recommended to the student. He would certainly be rewarded for this labour, by becoming as independent as possible of the narrow opinions of his age.

By such a study of the history of one particular branch of science, we gain an insight into the development of the whole mind of man. It is not merely chemistry, it is all human knowledge, which, although with unequal distinctness, is always intimately connected with the nature of things, that has constantly developed itself by a perpetually renewed struggle, but which has nevertheless resolved itself into a

perfect harmony. And it is not merely science, not merely human nature, it is the whole of nature which is developed in conformity to these laws. We should have to describe an entire branch of natural science, and an entire history, were we to exhibit this in its full extent. I must therefore satisfy myself here, as in the preceding pages, with the representation of one single view. The development of the earth seems to me most adapted to our present purpose.

We are enabled to pierce the obscurity which conceals the history of our globe, by penetrating its interior, and comparing the older and newer strata. We learn by our researches into these strata, and by the fossil or petrified animal forms which they contain, that the globe began with a mighty power of production, though in few determined directions. Through alternate enlargements and contractions, it has gradually destroyed and buried its earliest inhabitants, to make room for the existing chain of creatures, with man at their head. It is clear to every unprejudiced observer of nature, that the powers of production and of improvement have been in alternate action, though with constant and increasing preponderance on the side of improvement, and that the earth has only reached its present point of development after many struggles. In short, the development of the earth was the same as that of the human mind.

This accordance between nature and mind can hardly be ascribed to chance. The farther we advance, the more perfect you will find it; and the more easily you will admit with me, that both natures are germs springing from one common root. I hope that I have at least caused many of you by this to reflect more deeply on this rich material for thought. You will easily perceive that these hints are not disconnected with our subject; we have glanced at a higher order of physics, in which the development of science, with all its apparent contradiction, is itself a part of natural science. It shows us that all, in the great whole, has sprung from one common root, and is to be developed for one common life. But where something is to exist, to work, and to grow, the forces must have quitted their perfect equilibrium, and the struggle must have begun. One force must have conquered, though only for an appointed time. Another must then have preponderated, but this must also have been compelled to yield when it had brought forth its product, and threatened to

advance further, and to disturb the remainder. While every thing in the great whole, down to the smallest part, varies between hate and love—while the inquirer himself must share in this vicissitude—while even his own human passions may be set in motion by the external impressions of nature, he may yet preserve security and repose amidst this vortex; indeed, I may venture to say happiness, if he only steadily fixes his eye on the firm unity, which no power on earth can destroy.

TWO DIALOGUES
ON THE
FUNDAMENTAL PRINCIPLES OF BEAUTY,
AND ON
THE PHYSICAL EFFECTS OF TONES.

THE first of these two Dialogues was written more than forty years ago, and was printed in the Transactions of the Scandinavian Society, in 1808. It contains my fundamental views on the nature of Beauty; but it goes no further. Since then, I have from time to time continued my researches upon the same subject, and given them more extensive development, so that this dialogue is to be considered as the beginning of a series of dialogues, lectures, and treatises, on the natural philosophy of Beauty. Most of these essays have not yet been in print; but I now intend to publish them. The present two dialogues may therefore be considered as a specimen of the whole collection;—still it is to be observed, that the first of them bears the character of the period in which it was written. This character I could not efface without re-writing the whole; nor am I desirous to do so, for if such a production be submitted to considerable changes, it generally loses more of its freshness and power than is redeemed by greater correctness. The second dialogue was written twenty-five years later.

THE SAME PRINCIPLES OF BEAUTY EXIST IN THE
OBJECTS SUBMITTED TO THE EYE AND TO
THE EAR.

AN ESSAY.

ALFRED. WALDEMAR. HERMAN. FELIX. JULIUS.

HERMAN. You come too late for the festival, dear Walde-
mar; the concert is over, and all have left.

WALDEMAR. The last news is the worst; for, to say the
truth, I did not come for the sake of the music, but to meet
several friends, who are in the habit of being here.

FELIX. Then you were not aware of the kind of music we have had.

W. Well, but supposing I had known it?

F. Then, I am sure, you would have come.

W. Do you consider me such a great lover of music?

F. I always suppose the best.

W. If you consider it as a virtue, I confess, that I fail in this perfection; but then I must again allege, as my recommendation, that I am a friend to a good table.

F. A most strange recommendation!

W. Is it a greater merit to like one pleasure more than another? I am aware of no such order of precedence. One person loves pictures; another a good glass of wine; a third music; a fourth a good repast. Let every one seek his pleasure as he himself likes best, but let him not attempt to force it as the most excellent on another.

F. You are not afraid of a paradox?

W. No, not when it is a simple truth.

F. You depend upon the existence of certain paradoxes, which it is not worth while to refute.

W. Especially when they cannot be refuted.

F. Your paradox is certainly like most of them, easier to invent than to refute.

W. I do not require you to trouble yourself, any more than I shall waste my time by refuting you. Every man may retain his own opinion, if he pleases.

H. That is always a resource in case of need. Besides I think that it would be difficult to refute you; but this you must allow, that music, and the other productions of art, may be enjoyed by the whole world, without being consumed; whereas the other enjoyments which you compare with them, consume their object.

W. Here you have an economical advantage on your side. Your enjoyment ought to be introduced among the poor.

F. And you consider it to be unworthy of your attention that the works of art, derived like the solar rays from an exhaustless source, everywhere diffuse life and joy.

W. Nay, I think that you have expressed it beautifully.

F. And nothing more?

W. No; I see no proof by it, that music bestows an enjoyment of a higher order. Music stimulates the nerves in an

agreeable manner; a dish of spices does the same. Wherein lies the superiority of the one over the other?

H. As you represent the case, indeed, the superiority is on neither side; but you assume without any proof that music is only a sensual enjoyment.

W. I think no demonstration is necessary to prove that. Music is apprehended by the senses, and the feelings it awakens in us cannot be resolved into ideas; they cannot be comprehended by simple reason; what are they, then, but perceptions of sense? If therefore I were to make an order of precedence, I would place the art of painting somewhat higher, inasmuch as it allegorically represents some profound truth. Yet I must confess that I much prefer the simple truth represented in clear daylight. It appears to me that beautiful colours and forms have the same analogy to truth as sugar to a bitter draught which we give to children. As long as there are children, in a literal and moral signification, so long may the sugar and beautiful colours also retain their value. Nay, I will even go so far as to ascribe a similar use to tones, as, when combined with poetry, they serve to impress important truths, and rules of life on sensual man. But painting and music are generally only the sensual means of allurements to virtue; they are not virtue itself. This remark may likewise be applied to poetry, which also clothes itself in the sensual garb, in order to effect a rapid and powerful influence; but yet it only receives its true value from the wisdom it imparts and the virtue which it preaches. By this you perceive that with regard to its intrinsic value, I place poetry far below science, although it may often act more beneficially and more powerfully on the human race at the present day than arguments drawn from reason.

F. But has no flow of melody ever raised you high above the earth, never disposed you to feel joy, nor depressed you into soft melancholy? Has it never taught you to understand a poem more completely, never placed you in a more intimate connexion with all your fellow-creatures? In short, have you never experienced the sublime feelings and the heavenly disposition of mind in which we are transported by the works of art; an effect which music appears to produce even in a higher degree than the plastic arts, because we cannot withdraw our ear from its impressions as we can the eye from the impressions of the latter.

W. As I am organized like other men, I must necessarily receive the same impression on the senses, and through them be similarly moved. I will even allow that the productions of art have often transported me along with them, into a more elevated mood; but I am far from viewing this as a virtue in myself as a reasonable being, although it may indeed be regarded as a virtue in my senses, that they are so soon and so easily affected. The reason why music is apt to awaken higher feelings within me, I explain in a manner which will not exactly agree with your poetical ideas. I believe that those tremblings which are awakened in the ear by tones, and which are spread over all the nerves, have a physical influence in augmenting the activity of the nerves. You are aware that wine has a similar effect, and that even Cato's virtue was excited by wine. Intoxication is produced by music as well as by wine, though in a different manner, and when you spoke so enthusiastically of music, you spoke as a drunken man does of wine. You then praised music with justice, because it has a greater power of intoxication than the plastic arts. But to take the case seriously, you here place weapons in my hands against yourself; for if I enter into your mode of representation, it is surely proved that if the effects which pass through the hearing, as a less perfect sense than sight, nevertheless act more powerfully, it must be on account of their lower, and not on account of their higher nature. The lower the grade of organic development, the stronger it is. What powerful incitements are hunger and thirst! what heroic deeds are performed by the passion of love! In comparison with these the pleasures of the ear are but feeble, though far more powerful than those of sight; whereas the pleasures of sight are stronger than those of reason. It therefore becomes in all ways an incontrovertible truth, that music is only a sensual enjoyment, somewhat more elevated than most, but yet less exalted than that of sight.

F. Let us now break off. You may continue to dispute my opinions with your cold reasonings, but I cannot impart my feelings to you. Yet if I cannot justify them in your eyes, I will not therefore reject them; but hidden from the gaze of sophists, I will feed the holy flame in the inmost recesses of my heart.

W. That appears, however, to be a desperate situation.

F. When I know that I am in possession of a glorious treasure, what matters it that you have not recognized it, or rather that you will not learn to recognize it?

W. But suppose I persuaded you to doubt the genuineness of your treasure?

F. Then I would go and look at it again, and all my doubts would vanish.

W. If you only possessed the proper test for your treasure!

F. That is in my heart.

W. And is that genuine?

F. This is too bad.

W. I mean as a test.

F. Your endless doubts torture me. I will prepare a counter-argument before our next meeting. Pardon me, ye sacred Muses, that I have not been better able to defend your cause.

JULIUS. Console yourself with the reflection that they, at least, will not chastise you. I must confess that I am quite of Waldemar's opinion, that the effects of music ought not to be so adored as many of its friends are willing to desire. Similar to so many other pleasures, the chief part of the enjoyment springs from the imagination. How much pleasure is found by many in acquiring posthumous fame, and yet what is this but a phantom? What an intoxicating delight is love, and yet where is all its bliss, except in imagination? With what devotion do not whole nations solemnize feasts for beings who only exist in fancy? It is well known by experience that it is easy to make children believe things to be agreeable which are really the reverse. It has already been often remarked by philosophers and poets, that grown-up persons are to be regarded as great children, who are guided both by habit and imagination in their joys and sorrows. And it is the same with music. By the variety of tastes we perceive that it all depends on imagination. The music which pleases one displeases another, is detested by a third, but is received with enthusiasm by a fourth. Who does not know how much we are influenced by the association of ideas? Those who have heard music accompanied by beautiful words, or sung by a beloved friend, or executed in an imposing manner, will love it to the end of their lives, although under other circumstances they would not have discovered anything remarkable in it. I have been much delighted

by the story of the musician, who played a piece of music by another composer to his dog, and whenever he came to certain passages, he beat the dog. He succeeded so well in this trick that the dog at last howled of its own accord whenever he came to those parts where he had been beaten, so that those who did not know the trick, thought that the dog howled at the discordance of the music.

W. You do not, however, go very far in your agreement with me.

J. Yet I think that I have contributed my part in assigning that position to music in which you would place it.

W. I do not deny that we are allies; but does that mean that we are agreed?

J. In what do we then so much disagree?

W. Do you not say that the pleasure we find in music depends on accidental circumstances?

J. Yes, certainly.

W. And on nothing else?

J. On nothing more, as it appears to me.

W. And in my opinion it depends on the nature of the organ by which we receive the impression.

J. Exactly so.

W. I therefore say that it depends on the *necessary* nature of things, while you assert that it only depends on accidental concurrent circumstances.

J. Is the contrivance of the ear, then, so necessary and unchangeable? It appears to me that what I have adduced clearly proves that there is a great difference between the ears of different persons.

W. You have shown that one person finds pleasure in one piece of music and another in a different piece.

J. Yes.

W. It is the same with illness. For instance, it is generally asserted that we may become ill by exposure to cold, and yet we do not take into consideration that those who expose themselves most to the keenness of the air least suffer from it. We may, therefore, justly consider those illnesses which proceed from cold to be imaginary complaints.

J. A strange conclusion!

W. And the effects of medicine no less depend on imagination.

J. I should rather be inclined to agree with you in the

latter remark ; for medicine, when delivered according to the prescription of a physician in whom the patient confides, often acts very advantageously, when on the other hand it has no effect if prescribed by another.

W. For instance, if a doctor prescribes a sudorific for two patients, the one who has confidence in him will perspire, while the other who has none will remain cold.

J. What singular examples you choose !

W. Or, if he prescribes wine for two persons in a feeble state, the one who has confidence will find himself strengthened, the incredulous one, on the contrary, will not.

J. I see plainly that you bring forward examples in order to refute me. But may I ask, do you then entirely deny the effects of the power of imagination in illness ?

W. No.

J. What then is your meaning ?

W. A very simple one. The power of imagination, which I consider a physical quality, affects the body according to certain laws ; the medicine possesses its qualities in accordance with equally fixed laws ; and finally, the organization counteracts no less according to unchangeable laws of nature. The same may apply to warmth, cold, air, and outward circumstances. All these powers are in co-operation, combat against each other, support each other ; in short, bring about a final result which might be previously calculated from the powers which are known.

J. And how do you account for the variety in musical tones ?

W. I must answer you by another question :—When you strike two or three different strings, which are extended, and obtain unequal tones from each, you will then say that all extended strings in truth yield tones ; but which of them is accidental ?

J. No ; I by no means deny that the inequality depends on the extension of the strings.

W. Well ! on their tension, their thickness, their length, and the materials of which they are made. That the extended string yields tones is consequently necessary, because it is extended ; and that it yields a certain tone is necessary, because it is extended in a certain manner.

J. Of course.

W. If the ear is perfectly constructed it must necessarily

both receive and hear tones; and that different ears should be better qualified to receive higher or lower tones in different combinations of tones, is also necessary, according to their individual organization.

J. This is certainly undeniable; but all this individuality does not do away with the general rules for taste.

W. By no means. Only observe the different classes of rules. Some are applicable to all persons; others, on the contrary, only to certain classes of persons. Thus it is certain that no one has more pleasure in a harsh discord than in perfect harmony. No man in his senses is melancholy when he hears a whirling waltz or particularly merry when he hears slow, progressive, choral music. All the common rules of music may surely be equally applied to all people in their senses, but as none of us are skilled in music, I cannot enumerate them, nor can you understand them. It is, on the other hand, somewhat singular that certain pieces of music act with far more force on some constitutions than on others. The more numerous the tones, the richer their artistic combination, so much the more finely organized and practised must be the ear in order to comprehend them. It is obvious, from this—that savage nations only understand very noisy music, of the least complicated kind. In short, the rules of art are everywhere the same, but the degree in which a work of art is enjoyed is as different as the most civilized European compared to the rudest savage.

J. If all difference in taste only depended on difference of degrees, then you would perhaps be right. But even those persons who are furnished with the most delicate and practised organs are often of different opinions.

W. You misunderstand me. It is not my meaning that all differences in musical taste depend on difference of degrees, but only that certain differences, and indeed a great many of them, do so; but I maintain that all differences in musical taste have their foundation in our nature, and are regulated by general laws. The ear, I mean the whole organ of hearing—both the inward and the outward parts of this skilfully complicated natural instrument—is evidently formed in obedience to the same laws in all men. Its communication with the brain is likewise regulated by natural law; the brain itself is a natural organ most intimately connected

with our highest powers of conception, and therefore no less submitted to the laws of nature. How will you then maintain that our sensations of beauty should be the mere result of accident?

J. I never wished to deny any of this; but now comes the judgment of the mind on these impressions.

W. Then you mean, that bodies are organised alike, and receive effects in conformity with the same natural laws, but that the minds of men on the contrary are so different that the same things produce wholly different impressions on them?

J. It certainly seems strange. But it is not to be denied that soul and body are very different things.

W. It might however easily be denied.

J. Then you are a materialist.

W. Exactly. What do you say to that, Felix!

F. That, considered from one point of view, you thus reconcile yourself with me; for the necessity by which the impression results from our organisation, which causes the pleasure we derive from music to be a contrivance of nature, gives it something estimable in our eyes, which it would entirely want if it only depended on imagination.

H. But yet it appears to me, that you view the pleasure we find in music, as too sensual. I believe that it principally springs from our consciousness of the skill of the performer, the ingenuity of the composer, and the difficulties both have to surmount; in short, that it has the same foundation as the pleasure which we derive from a well written poem.

W. Music and poetry have never given me this kind of pleasure; for it appears to me only a waste of time, for people to surmount difficulties which they themselves have made; and for good reasons, I cannot be more amused by the plan and ingenuity of a piece of music, than I can by the plan of a battle. Besides, I beg you will consider the nature of our pleasure in music. He who is excited by a piece of music, will seldom be able to tell you why he is pleased, but his pleasure is great—it is an intoxication. He, on the other hand, who is pleased with a knowledge of it, can tell you the reason, and his enjoyment lasts longer, though it is far from being so great. If our pleasure in music depended on an insight into its arrangement, then it would be incom-

parably less than the enjoyment which proceeds from a well solved arithmetical problem.

F. And therefore the end of all our research is this: that we do not know why we are pleased with tones. Well then, cease to dispute about it, and admire that divine art, with which invisible magic awakens inexplicable feelings in our breasts. Go, and imbibe the stream of tones, and revel in them. If you then feel yourselves penetrated by a higher spirit, if you are in the enjoyment of inexpressible delight, you then understand tones, and need not trouble yourselves to inquire why you are borne heavenward on the streams of musical tones. Who knows the nature of red, blue, green, or the other colours, or why by an artificial combination they can produce the most admirable effects? And yet we are to conceive how fleeting tones which last but for a moment are able to produce divine harmony! How much wiser Alfred has been, who has sat silently drawing figures in the sand while we were talking. Is it not true, Alfred, you have been absorbed in mathematics, while we were disputing about the effects of music.

ALFRED. Both in mathematics and in music: I was endeavouring to draw some tones.

J. I should much like to see that kind of drawing, for I have never yet seen a tone.

A. It is true there was a little jesting in my words, but yet there was something serious also. The tone itself, which is only a perception in the organs of hearing, you cannot naturally see; but the whole agency, whence this feeling is awakened, its whole mechanism, can be made visible.

J. How so?

A. By producing tones on glass or metal plates strewed with dust. Have you not seen in this experiment, how the dust arranges itself in certain regular lines, and forms all kinds of figures?

J. Yes, I remember having seen this performed long ago by Chladni. He showed us, that if we produce a tone on such plates, there arises, as if by a magical stroke, a beautiful and regular figure. He said that it came from certain symmetrically placed parts being brought into an oscillating motion, while the others remained at rest. If the stroke of a violin-bow did not produce a tone, but simply a harsh sound, then no beautiful or symmetrical figure would appear.

A. Consequently, a beautiful tone and a beautiful figure are connected with one another.

J. Not entirely, for those tones which produced Chladni's acoustic figures were frequently harsh and unpleasant.

A. You are right. But this unpleasant impression hardly proceeded from the tone as a tone, but from that modification which every tone receives from the quality of the body by which it is produced; for, as it is well known, the same tone sounds differently from a string and from a flute; differently from a flute and from a glass plate set in vibration by a violin-bow.

J. In that you are undoubtedly right.

A. A beautiful sound, therefore, is only produced by symmetrical oscillations.

J. This is really interesting.

A. It is perhaps more than that.

W. It seems, Alfred, that you agree with Herman.

A. Not if I have understood him rightly. But as it appears that you wish to draw me into the conversation, I ought first to know if I have comprehended your thoughts correctly, while my mind was occupied with other things.

W. That is but just.

A. Listen then. If I am not mistaken, it was your opinion, Waldemar, that our pleasure in music is only sensual; Herman considered that it depended on reason; Julius, on the contrary, regarded it only as resting on imagination.—Was it not so?

W. Exactly.

A. At first you asserted that music did not give any higher pleasure than that produced by the appeasing of hunger or thirst, and other instincts, which are found even in the lowest organized animals; but it afterwards appeared to me, that you still were not disinclined to place the pleasures of the ear above that which we obtain by most of the other senses, though below that of sight.

W. Well.—You will not be far wrong if you assume, that my first assertions may be ascribed to a spirit of contradiction, which was aroused by our friend, Felix, having accosted me with so much zeal.

A. According to your opinion then, we are pleased with music in consequence of a natural law, as is the case with the other senses.

W. That is my opinion.

A. You, Herman, on the contrary, believe that the pleasure we derive from music not only depends on reason, but that we are even conscious of it during the enjoyment.

H. I thought so, but Waldemar has made strong objections to this. I long much to hear your opinion.

A. My opinion is shortly this; that, with you, I assume that the pleasure we find in music depends on reason, and, with Waldemar, that it depends on the senses.

H. How do you combine these two opinions?

A. You shall see. In the first place, I quite agree with Waldemar, that the pleasure which music affords is unconscious of its origin.

H. Have you anything to add to his arguments?

A. If necessary I might add this, that we also feel pleasure or displeasure in a sound, which appears to us sometimes justly and sometimes unjustly, as entirely isolated, when consequently we cannot imagine any plan, any difficulty surmounted, or anything of the sort.

H. But if we fail in this consciousness, how can our pleasure be reasonable?

A. Because tones and their connection contain a hidden reason, which unconsciously penetrates our minds.

H. Now that is inconceivable to me.

A. When we have viewed the case more narrowly, your difficulty will perhaps disappear; if you feel disposed, we will first regard beauty in visible objects.

H. We shall there at least have something more certain to cling to.

A. Do you not in general find that the symmetrical figures which are conformable to rules, are more beautiful than those which are unsymmetrical and conformable to no rule.

H. Certainly: that is not to be denied.

A. But do you not consider the symmetrical, and that which is bound by rule, as something conformable to reason.

H. If you ask whether I think so, I answer yes: if on the contrary you ask me if I know it, then I must answer in the negative.

A. When you see a person draw a number of careless strokes in the sand, do you not then think that his thoughts are otherwise occupied.

H. Undoubtedly.

A. But if, on the contrary, you see him draw a circle, or an equilateral polygon, then you surely think that he does it with a certain premeditation.

H. No doubt there must be some thought in his mind about the composition of the figure.

A. Consequently the symmetrical, and that which is bound by rule, bears at least the stamp of reason, even though it may have been accidental.

H. It cannot be denied.

A. And do you not think that mathematical figures are representations of ideas?

H. Undoubtedly they are no more than the construed definition.

A. But do you find nothing more in them?

H. What more?

A. If you say that the circle is a figure, whose circumference is everywhere equally distant from the centre, you certainly have an idea of the circle, and if you describe a circle you may also indeed be said to construct this idea; but if you regard a circle which is already produced, then you may easily see in it a number of other properties, which belong to its nature, and yet somewhat differ from its idea. You see that two diameters, standing perpendicularly on each other, will divide it into four quadrants; that the angles which the radii inclose, must always stand in proportion to the arcs belonging to them; that the circumference must always be in a certain proportion to the diameter; in short, you see countless properties which, regarded from the one side, are different, while from the other, on the contrary, they are the same as the nature of the circle. This variety, dissolved into a oneness, now stands before you, although in an unconscious manner, when you behold a circle, and you find it beautiful, although you are not aware, or at least you do not think of all these properties. Even that remarkable property, that its circumference incloses a greater surface than any other line of equal length, and that it is described by an uninterrupted change, whilst the same is yet incessantly produced, this absolute oneness in this infinite change, you behold with admiration, without being conscious of the whole greatness of the idea.

H. I confess it.

A. But does it not appear to you, that this infinite source

of thought which you thus find in a figure, is something more than an abstract conception?

H. It seems so to me.

A. Could we unite all these thoughts in one, it would then be an infinite thought, an idea, in the Platonic sense.

H. That is undeniable.

A. But even if we could not represent this idea in words, it still exists in the circle.

H. That is evident.

A. The circle is consequently the representation of an idea in that Platonic sense, which I shall adopt in the continuation of this discourse.

H. So it appears to me; but may we venture to assert that it is beautiful as the representation of this idea, and from no other cause?

A. Do you not suppose that the idea of which we speak, ought to be one with the nature of the circle?

H. I do.

A. And do you then think that the circle, or any other mathematical figure, can have properties which do not belong to its nature?

H. We cannot indeed suppose that to be the case.

A. Therefore the circle is beautiful in consequence of its nature, or in consequence of its idea; but this would perhaps become still more evident, if we endeavoured to give reality to this idea.

H. Certainly.

A. If you were required to state a reason why you find beauty in the circle, you would undoubtedly mention its infinite symmetry, its completion in itself, forming as it does a self-satisfying whole, if I may use this expression, and bearing in its immeasurable variety the stamp of oneness. It is this mighty oneness of thought, that affects you without your knowing why. Is it not so?

H. It appears to be so. Now I will venture to guess your meaning. Were we to translate the nature of the circle into the language of reason, so that all representation of space, as something connected with the senses, disappeared, and nothing remained behind but pure idea, we should be compelled to say that the circle is that which is perfect in itself, that which in itself has resolved all diversities into oneness.

A. I do not, however, quite represent the matter to myself in this manner.

H. I perceive that I have somewhat failed in the way that I have expressed myself. I ought not to have said that the circle is perfect in itself, but only its delineation, as far as it can be given on a plane surface.

A. So I imagined, and yet it was not that to which I alluded; I would not have space excluded from the idea of the circle.

H. But then it becomes something connected with the senses.

A. In a certain signification, I represent the idea to myself as a union of reason and sense.

H. This surprises me.

A. I perfectly well see that a meaning might be attributed to my words which would be a real absurdity. It is therefore necessary that I explain myself. You will already have easily guessed, or rather understood, that I did not speak of the outward senses, but of the inward sentient faculty, the inward sense.

H. Of course; you mean our mental faculty to represent things to ourselves directly, without any intervening thought of which we are conscious; that which we call intuition.

A. Just so. And although I find something one-sided in this expression, I propose that we use it here. My meaning then is, that the idea is an intimate union of thought and intuition.

H. But then the idea ceases to be a purely rational thing.

A. Let us not determine anything about this yet; but let us try to turn our thoughts to the case before us. We are agreed that all the manifold thoughts, which are to be discovered in the circle, are necessarily connected with one another, and constitute a oneness. But this necessary connexion is not contained in the primitive notion, as it is exhibited in a definition. If we deduce the thoughts from the definition, this is not done without the aid of intuition; so that we cannot say that they lie in the primitive notion; but that they are necessarily connected with it. Were we to begin with whichever property of the circle we please, we could, though with far more difficulty, deduce all

the remaining properties of the circle from this one. We shall certainly never find one thought in which all these thoughts can be said to be included; but yet we have the full perception that the circle we have apprehended by intuition is a totality of thoughts. When we have now made ourselves familiar with all these thoughts, and observed their connexion, so that all this presents itself as a unity to our mental nature, it is as if all the thoughts found in them, now presented themselves before us as reminiscences, and formed a complete impression. Thoughts are here apprehended as intuitions, but yet with the consciousness that they are thoughts. Idea is thus the intuitive oneness of thoughts. It is conceived by reason, but as an intuition.

H. Then it is this which is conceived in the Beautiful. But you thus seem to refute the assertion you before brought forward, that we receive the impression of beauty without being conscious of the idea contained in the Beautiful.

A. This may seem to be a contradiction, but it is not so. The idea is a unity of thoughts, which we have perceived with a consciousness of their nature, and whose connexion has been rendered evident to us by thinking. It is, as it were, by an act of memory that we afterwards comprehend them as a whole. Thus we perceive in our minds the well-known thoughts, as if they formed a picture. This we call a mental intuition. The perception of beauty, so far as nothing else is mixed with it, passes without any knowledge of the idea, though the pleasure perceived originates from the secret harmony between our sensuous nature and our reason.

H. Now I think I understand you better. *The Beautiful pleases us as the image of an idea, without our being, at the same time, conscious of the idea itself.*

A. That is my opinion. But you will now see that the idea of the circle represents itself to us far more limited, but also far more determined, than you lately comprehended it. Its limitation does not prevent us, however, from feeling that it contains a reference to the former more comprehensive idea.

H. All this appears to me [to be sufficiently clear, with regard to the circle. But can we now, according to the same principle, find beauty in other mathematical figures, which make a pleasing impression on the eye.

A. Do you not find among those figures which are bounded

by straight lines that the equilateral are in general more beautiful than the inequilateral; and the symmetrical always more beautiful than the unsymmetrical?

H. Undoubtedly. But is not the inequilateral also the representation of an idea?

A. It is not to be denied; but it has more of the stamp of arbitrariness, less of the stamp of reason.

H. I should like to be perfectly convinced of this.

A. If you conceive a triangle only as an idea, do you then imagine a determined proportion between the sides, or angles?

H. Certainly not.

A. If you then were to draw this triangle, there would be no reason to draw the one side or the one angle greater than the other.

H. That is true.

A. And if you made any change in it, this would be the effect of your determination.

H. Certainly.

A. Consequently the equilateral triangle represents the conception most entirely free from the additions of will.

H. So it appears.

A. Besides, the equilateral triangle, placed in its determined character in opposition to the inequilateral triangle, contains a far more perfect resolution of variety and dissimilarity to oneness; for it has different sides, indeed, but they are equal; its sides have certainly different directions, but they are equal in proportion to each other: every line that passes through its centre does not, indeed, divide it in two equal parts; but yet this is the case with all lines which bisect an angle. In this way you see in the equilateral triangle a multitude of thoughts dissolved into one unity, whose inward nature is an idea.

H. I perceive it. I also am able to conceive from this, why the square makes a better impression on the eye than the equilateral triangle; but now what is the reason that the equilateral hexagon appears to us to be far more beautiful than the other polygons?

A. The preference for the hexagon cannot, perhaps, be so generally admitted; but so much, however, is certain that it contains great symmetry; for all the lines which are drawn

from the centre to the corners are not merely, as in other polygons, equal to each other; but they are also equally great with the sides, so that the principal radii divide it in perfect equilateral triangles. This proportion is felt by the eye, even if the radii be not described. As it is now surely clear, from what has been previously stated, that all symmetry is the result of a deeper unity, so I need scarcely adduce more to explain the superior beauty of the hexagon.

H. I perceive it.

A. And now do not seven-sided, eleven-sided, and thirteen-sided polygons make a far less agreeable impression on the eye?

H. Who will deny it?

A. Nor are their opposite sides parallel, any more than that they can be symmetrical. The nonagon, on the contrary, can be divided into three symmetrical parts, which again consist of three equally great triangles; therefore this figure also pleases the eye better than most of the other inequilateral figures.

H. You seem to me perfectly right. I now believe with you, that the beauty of forms only originates in the ideas which they express, and that this acts on the outward and inward sense without our knowledge.

A. And this thought, that they are ideas, infinite thoughts, which reveal themselves to us in the beautiful, I beg you will firmly retain in the following researches; for this appears to me to give a high conception of beauty, higher than I can express. I therefore fear much, that from too great an endeavour after clearness, we have not expressed ourselves in a manner worthy of the matter.

J. Do not regret that you have spoken clearly. Besides, you have led us far enough away from the subject.

A. Then we will return to it with the advantages we have acquired.

J. I fear that they will not be very great. It has astonished me much, that you have employed so long a time in seeking the nature of the beautiful in objects which do not belong to it. At least, I have never heard mathematical figures classed among them.

A. Tell me, do you call the fundamental rules of logic rules for the understanding?

J. Undeniably so.

A. And he a man of understanding who does not sin against them?

J. No, not exactly that.

A. Then he whom you would call a man of understanding, must consequently possess a more than common understanding?

J. We are taught that, even by our mode of expression.

A. And thus, we only call that beautiful, which possesses uncommon beauty. What the rules of understanding are compared with knowledge, such are those fundamental forms, in comparison with organic beauty. There is an immense chasm between them.

J. So immense that I am afraid of taking the leap.

A. You need only observe some of the fine arts, for instance, the productions of architecture, to find again those geometrical primitive forms. Yes, even through the whole of inorganic nature, you find the geometrical forms infinitely repeated. Is not every crystal a geometrical body, composed of innumerable crystalline parts. The pleasure with which we regard those objects bears sufficient testimony to their beauty. As soon as you step out of inorganic nature, the straight-lined and plane boundaries cease, and curves of the most ingenious bendings appear, in greater and still greater numbers, the higher you ascend in the rank of organization. Inorganic beings constitute the elementary, and organic the higher geometry of nature.

J. But yet, all these crystals and other natural forms have often arisen by accidentally concurrent circumstances.

A. Accidental at first sight, but necessary in themselves. But if they were only accidental, yet in consequence of their regularity they bear the stamp of reason.

J. I should be rather inclined to believe the last.

A. This must however suffice. It would lead us too far from our subject if I here attempted to prove more to you; yet I cannot do otherwise than refer you to that which a slight observation of nature soon teaches us, that all effects obey natural laws; that these laws stand in the same necessary connection as one axiom in reason to the other. That this combination is precisely a combination of reason, we learn from this, that by reason we are enabled to deduce the one law of nature from the other, and by the known laws to discover new and unknown ones. Innumerable as are the.

effects determined by natural laws in every object in nature however insignificant it may be, I deeply feel an infinite, unfathomable reason within them, of which I can only comprehend by fragments an incalculably small part. In short, nature is to me the revelation of an endless living and acting reason.

H. I think that you have neglected an argument of great weight against Julius, viz., that our sense of beauty is offended by diagrams which deviate sensibly from regularity. A line that is neither straight, nor has any regular curvature, a figure resembling an equilateral polygon, or a circle, or an ellipse, yet without answering the idea in all its parts, is declared ugly. But it is evident that we cannot declare a deviation from a form to be ugly, without attributing some beauty to that form.

A. I entirely coincide with this reasoning, but I thought that I had already said sufficient upon this subject in the beginning of our conversation.

H. True! nevertheless as Julius seems to have overlooked it, I thought it was better to bring it forward. I am however, much satisfied with the turn your discussion has taken, for it has given you an opportunity to throw some light upon our feelings of the beauty of nature, and to show that they are founded on the very nature of reason. But I have therefore become still more desirous to hear your opinion about music.

A. Did we not before say that no beautiful sound could be produced except by symmetrical vibrations of the sonorous body. You remember what we said about acoustic figures.

H. Not alone that, but our conversation has sharpened my half-slumbering memory, to recall clearly the well-formed figures in which the sand must arrange itself each time we cause the plate to produce a clear tone.

A. But if I now showed you these figures, produced by the finest dust, and you there saw how each figure was again formed by a union of innumerable smaller parts, you would comprehend still more perfectly the infinite quantity which exists in a single tone.

H. I should much like to see them.

F. Alfred has shown them to me. You should see how the dust is raised into a countless number of little hillocks, by a stroke of the violin-bow. Those elevations which are nearest to the lines of repose, are so small that they can

scarcely be seen; the farther we diverge from these, the greater we find them to be, the greatest are placed at equal distances from the lines of repose. They are thus symmetrically distributed in the symmetrical divisions of all the figures. By a single fresh stroke of the bow, all is again set in motion; the hillocks are suddenly changed into waves, and every wave seems to boil, the innumerable smaller ones rolling about within them; but they all hasten in a symmetrical dance, on a prescribed path, towards the great resting-space. Yes, a motion, a life, a creation is there exhibited, that must have been seen to be conceived.

H. Excellent.

A. Now Julius, does it not likewise appear to you that reason lies hidden in tones?

J. I cannot deny that all this symmetry has something admirable in it.

A. But I observe, that you have hitherto permitted me to neglect one question entirely.

J. And what is that?

A. That a vibrating string also yields tones, and yet there are none of the acoustic figures in it.

J. Good: we will not exempt you from that. Tell us therefore, how will you combine this with your mode of representation?

A. The different parts of the string make unequal efforts to vibrate. Now, these efforts are also distributed symmetrically on the string. It is easy to perceive that every part must have an arch of vibration which agrees with its distance from the nearest fixed point of the string. A vibrating string, particularly if it be not too thin, will in a suitable light show the regularity of its bending.

J. Granted!

H. But as yet we have only examined the single tones, and not their connections.

A. We will take them also into consideration. But I will carry on the conversation about them with Julius, because he is the one who doubts the most.

J. I willingly consent to it.

A. You certainly admit, in accordance with all scientific men, that tones are produced by a vibrating motion, and that they are so much the higher, the more rapidly the vibrations succeed one another?

J. I do not doubt that.

A. That the octave of a key-note has twice as many vibrations in a second as the key-note, that the fifth completes three vibrations while the key-note produces two, and so on, is all that natural philosophers have determined about the number of the vibrations in the different tones.

J. I certainly dare not enter into a dispute with all natural philosophers by denying it.

A. Furthermore, we may surely venture to admit in consequence of a general agreement, that those tones, the number of whose reciprocal vibrations stand in proportions which can be expressed by small numbers, are easily intelligible to and recognizable by the ear, which thence feels itself satisfied by them.

J. All this I shall leave uncontradicted. I also well remember having read that those tones which are expressed by other higher numbers, for instance 7, are dissonants.

A. Consequently, sounds are to the ear what forms are to the eye; for the eye finds more pleasure, and, as it were, satisfaction, in the square than in the simple rectangle; and again amongst the rectangles, it rather dwells on that one whose unequal sides stand in a very simple proportion to each other; for instance, as 1 to 2, 2 to 3, or the like, than on such a proportion as 1 to 7, 1 to 11, or perhaps expressed by a still greater number.

J. This agreement is not to be denied.

A. If we now consider the combinations of three tones, we again find the same laws. The most beautiful of all harmonies, in itself, is the chord of the major third. This consists of the key-note, the major third, and the fifth, whose proportion to one another may be expressed by 4, 5, 6, which is the simplest and clearest progression that the other conditions of the musical scale will permit. In the chord of the minor third, which consists of the key-note, the minor third, and the fifth, the proportion can only be expressed by 10, 12, 15, —a progression which is not so simple, and therefore less easy to comprehend than the former, and, as it is well known, expresses the less powerful and lively feelings. The same may be applied to all harmonies, namely, that they are the more pleasing to the ear in the degree that their proportion can be expressed by smaller numbers.

J. All this I also admit as established.

A. Do you not think it probable that principles on this calculation might be applied to far more compound proportions?

J. There can be little doubt of that.

A. I really believe in this possibility, although no mathematics have yet succeeded, and certainly never will succeed, in exhausting the theory of music. Nor is it to be doubted that we still want many data which would be required for a mathematical theory of music. But even were we able to calculate all the proportions in a symphony, we still do not see them during the enjoyment; for only imagine a symphony by Mozart! would the life-time of several mathematicians suffice to calculate all its beauties?

H. Do you then find no beauties in music unless they can be calculated? Is not the work of the composer essentially a poetical work; and you will not surely calculate this?

A. I certainly shall not calculate it, nor do I believe that any one can do so; but yet I think that it is founded on mathematics, although on deeper grounds than any which have yet come to our knowledge. But even as I assume that the eternal reason which surely also includes an infinity of mathematical knowledge, reveals itself in the human form, so do I also see a revelation of it in the work of the composer.

J. But then the artist becomes a machine!

A. By no means; for when I said that I regarded nature as the revelation of an infinite living and acting reason, you cannot well doubt that I consider spiritual nature itself as a part of it; and that I view what, according to another mode of representation, we correctly call natural gifts, as a spark of the Divinity. Or do you think it possible for the most lively power of imagination to devise anything greater concerning the genius of art, than what may be derived from our previous conversation, namely, that the artist by a happy feeling at once discovers and creates that which numbers of other men have not been able to fathom with their powers of understanding during many years of study?

F. I confess that I reproached you unjustly.

A. I may therefore venture to hope that you will also allow me to be in the right, when I say that we may account

for the source of our enjoyment of art, without at the same time depreciating that which is divine in it.

F. That I willingly allow. For what can be a higher and worthier pursuit than to produce works of art which harmonise with the most profound reason, without having calculated them ourselves; and those who are to receive the impressions not requiring such a calculation?

A. Consequently we might easily refute Julius, who is of opinion that all the pleasure we find in music depends on imagination; for we have now proved that this pleasure has a good and solid foundation.

F. So it appears to me. What do you say, Julius?

J. I can make no objection to what you have said; but I confess that such far-fetched reasonings as you have adduced produce no strong conviction within me, because I always feel that some erroneous inference must be concealed beneath them.

F. And whence should the reasons be drawn, unless from the nature of things which do not exactly lie open to every man's eye?

J. I willingly confess that I do not think any other proof possible, but on that account also the matter will always continue to be very doubtful.

A. Shall I tell you the cause of your continued doubt?

J. Can you do so?

A. Certainly, if you will promise not to be angry.

J. I promise.

A. As you yourself confess that you have no objection to make to my conclusions, so your *doubt*, or rather your *uncertainty*—for we should not always honour this feeling by giving it that name—can only arise from this: that you have not apprehended the reasons in all their parts with due clearness and power. Go and study the natural philosophy of tones, behold and investigate every important experiment, pursue the calculations of mathematicians, and prove them yourself. When you have thus acquired a clear and comprehensive knowledge of the subject, then return, and tell me if you are still in uncertainty, or if you have not either determined objections or a determined certainty about it.

J. I hope that I shall then have a determined doubt, but I have not time to gain this knowledge by so long a path.

A. Then you will always remain in uncertainty.

J. I must be contented to remain so.

A. Then let it be.

F. There is consequently but one still remaining with whom you have anything to decide, for Julius has now excluded himself from the dispute. Herman could easily be brought to agree with you, as he had already previously sought the agreement of reason in art, but he sought it in the wrong place. I, who held it to be unworthy to seek the source of the enjoyment of art, have become satisfied by your having shown me its source and nature in a manner worthy of the subject; now there is only Waldemar remaining, with whom by your own words you agree on some essential points.

A. I undoubtedly agree with him in this, that the pleasure we feel in music is produced by natural laws.

F. That is quite certain.

A. And is a result of our organization.

F. But this organization has a higher principle.

W. That Alfred must allow all organs to possess.

A. Let us, in order to be brief, connect our research with one of the common results of human understanding, namely, that all organizations do not possess equal organic dignity.

W. Might not this be a prejudice?

A. Consider the thing yourself. Who does not look with less pleasure on a fungus than on a piece of grass, and with still less gratification on this than on a rose? It is as if we despised the less perfectly organized creation in comparison with those possessing a higher organization.

W. I will not deny that we have a sort of higher respect for a natural object, in proportion as its organization is more ingenious and, as we may say, more profound. This we observe still more in the animal kingdom, where an oyster, a mussel, and such things are regarded with a sort of contempt, while a bird with its more ingenious organization, and still more one of the higher animals, as you say, really inspires an unprejudiced person with a sort of respect for its organic dignity. I will therefore grant without any scruple that an organization holds a higher rank the deeper and stronger the stamp of reason is impressed upon it.

A. And the stronger this is impressed, so much the more

does it appear that occult reason is awakened to some degree of consciousness in the creature.

W. Such seems to be the case.

A. And now with regard to mankind; reason there breaks forth into consciousness of itself. Man himself produces reason, if I may venture to use this expression.

W. We learn all this by experience.

A. May we not then venture to admit that the same difference which we have here found between organic beings, also exists between the organs of sense in every individual being?

W. It is at least very probably the case.

A. It is more than this. Do you not find that the construction of the organ of hearing is far more ingenious than that of taste, and that the visual organ is again far more delicate and intricate than this.

W. Much might be said against this; but it is indeed quite evident to an unbiassed spectator.

A. Besides, you know that the power of perception by the eye extends much beyond that of the ear, and this again much beyond the sense of smell; finally, the perceptions of the tongue demand direct contact.

W. All this is well known, and is beyond doubt.

A. Further, the inward perceptions which spring from the impressions on the organs of smell and taste are not so clear as those we receive from the impressions on the ear and on the eye. And, above all, it is worthy of observation, that those lower perceptions of sense cannot be so reproduced by the inward sense as the higher perceptions. We may be pleased with tones that we do not hear with the outward ear, as we perceive by the musician, who, merely by reading the notes, has a previous feeling of the pleasure which the execution of the music will bestow. We can enjoy pictures which are not beheld by the external eye. Yes, what is more remarkable than this, the artist in his imagination can produce new combinations of tones and colour; that is to say, new creations of pleasure for these higher organs of sense which act with power on the imaginative faculty, and he thus again obtains subjects from this.

W. All this I willingly admit; for it has never been my serious intention to deny that music and painting afford the noblest enjoyments to the senses.

A. But I would likewise have you consider that the subjects for these perceptions are of two kinds ; namely, those which external nature involuntarily offers us, and those which are produced by the artist. The last obtain all their being from our inner nature, which we perceive both in that on which we are agreed, relative to the enjoyment of art, as well as from this, that it is by his mental power that the artist produces his work ; so that the perception of the senses, through which it is communicated, is only, so to speak, the body of the mental creation.

W. I yield my opinion, and demand no further proofs.

A. Then let us cast a retrospective glance on the whole of our investigation. The pleasure that the Muses afford us is not merely imaginary, but a real enjoyment, which has its firm foundation in our nature ; not only in the construction of our outward senses, but in our inward being. It procures us enjoyments not merely by the strength of its impressions, by satisfying our desires, but by the most perfect harmony with our rational being. Yet the holy enjoyment of art does not spring from conscious reflection, but from an unconscious and mystic sanctuary. In every single tone there lies an inexhaustible source of activity in conformity with reason, and of harmonious life ; but every melting harmony, every resolved dissonance, is again a higher combination, which in itself bears the same stamp of reason, and in which all its parts co-operate towards an inward unity. Does it not appear to you that, in the original signification of the word, we may justly call that condition enthusiasm in which the artist produces a creation, replete with profound reason, which no finite understanding is able to comprehend. He pours it into your ear, and your enraptured soul feels itself exalted above earth, and a participator in unspeakable bliss. Let every one, then, who knows how to honour Nature and Reason, also reverence the Arts.

THE PHYSICAL EFFECTS OF TONES.

A DIALOGUE.

ALFRED. WALDEMAR. HERMAN. FELIX. SOPHIA.

HERMAN. Come, my friends, let us rest after our long walk. We are here under shelter ; but as this light summer-house is open towards the east, it offers us an extensive prospect, and not less beautiful than any we have lately seen.

FELIX. You are right. It crowns the day's enjoyments. How gloriously the peaceful water lies beneath us, so smooth and blue, under the bright cloudless sky. The opposite coasts, with their green woods and meadows, and yellow corn-fields, so entirely surround it, that it has the charms of a lake, and it yet retains somewhat of the grandeur of the ocean.

ALFRED. It is a perfect evening prospect ; it could not be seen from this spot in a finer light at any other period of the day. Herman has indeed found one of the most charming country residences I have ever known.

WALDEMAR. And how many traces there are around us of his activity in arranging and embellishing it. You should have beheld this place when he first took possession of it. Those who see it now can scarcely imagine how much has been cleared away, in order to obtain an open prospect, and how much has been planted to adorn the grounds immediately surrounding it. We may indeed say that Herman, and Sophia, (who has been an active participator in these improvements,) have deserved their happy dwelling. Even the growth and flourishing condition of the plantations, which we might apparently ascribe to good fortune, is in many respects owing to their judicious care. Although they have spent twenty years in this work, the time seems short when compared with what has been accomplished.

A. You remind me how neglectful I have been. During all these years I have never once visited my dear friend. Yet I am not entirely to blame.

H. I am aware of that. We have all of us reason to be surprised when we look back on the daily intercourse we enjoyed during the latter years of our youth, and the long separation that followed. Do you know that it is exactly five-and-twenty years to-day since we four friends have met under the same roof?

W. A quarter of a century! It is indeed a long time. But so much the greater is the pleasure that we meet each other again in health and happiness. I still remember, as if it were but yesterday, the evening that first converted the acquaintance between Alfred and the rest of us into a friendship from which we all derived so much pleasure during the few years we were permitted to be together.

H. I am not far behind you in that. I well remember the evening when we had that long conversation on the pleasure we derive from tones, or, as I would rather call it, our conversation on the Beautiful, for it was by no means confined to what pleases the ear alone.

F. It might be worth our while to reconsider the subject, and try how far our views have been matured since that time.

H. I both accede to your proposal and am ready to support it.

W. But your wife was not present on that occasion. It will not interest her to take part in the continuation of a conversation with which she is unacquainted.

S. It is not altogether unknown to me, for although I was not present when it took place, Herman has told me its chief contents. It will be a pleasure to me to listen to a new conversation on the same subject; and with your permission I will ask questions about those things which I do not understand.

H. I know that you have already some questions to put concerning what I told you of that very conversation. Let us hear them now. They will serve as a beginning to our discourse. But I see by your looks that you would rather that I should put the first question in your name. Well then, Sophia said the other day, when we were speaking of your expected visit, that she wished to ask you whether,

according to your view of the matter, you could account for music creating a desire to dance, and governing as it were the movements of the dance.

S. I certainly said I wished to ask about it; but I almost fear now that it is an unsuitable question. Will science condescend to answer?

A. It would be a bad sign if science were above doing so, but the question is whether it is capable of answering it.

H. And if it were incapable the theory would be overthrown.

A. I cannot agree with you there. Science may contain a correct general view, without our being sufficiently acquainted with all the facts to which it is to be applied; for instance, in the present case, we do not perhaps know enough of those laws by which effects are produced on our own bodies.

H. For this reason, then, we must dispense with the answer?

A. Not entirely. Let us try how far we can go. It appears to me to be the surest way to begin with the actions of tones, or rather the vibrations of tones on inanimate things. It is well known that one musical string causes another, which is tuned alike, to vibrate.

S. How can that be?

A. The string which is first set in motion causes the surrounding air to vibrate, which vibrations are again communicated to other bodies.

S. But it seems to me still that there remains something inexplicable. If a vibrating string were to set every other string which is near it in motion, I then could easily believe that the shock which the air received from the one string would be communicated to the other; but as it is only the strings that are tuned alike that mutually tremble, it seems to me there must be a sympathetic feeling between them.

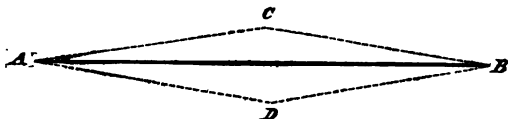
A. You are perfectly right in supposing there exists a sympathy between strings which sound together; but this sympathy has, like every real sympathy, its natural cause, and in the present instance this is known.

S. Can you make it comprehensible to me?

A. It will not be difficult if you do not find the considerations that lead to it too dry.

S. If I do, then I do not deserve to have my desire of knowledge gratified.

A. Well then, we will first consider what happens to a string after it has been bent out of its usual position. Let the straight line AB represent such a string,



and let the dotted line ACB represent the same after it has been bent. It is evident that the string by being bent has become rather longer, and has thereby received a new tension. It will therefore return to its former position. But when it has arrived there, all its parts have received an impulse which sends it still further, and it takes up the position which is indicated by the dotted line ADB. But it has now received a new tension by means of which it will again retreat, and so it must incessantly continue to do, if it did not gradually yield some of its motion to the air, and lose some of it by the resistance it offers to the force which bends it.

S. This seems easy to understand. But does not a string vibrate more quickly the stronger it is bent?

A. Not if the curve is but slight, as is the case in music; for although it is true that the string is more extended the stronger it is bent, yet the space which every part has to traverse is also much greater. As long as the curves are small, one of these causes endeavours to shorten the time of vibration as much as the other to lengthen it.

S. Now I see the reason why a string yields the same tones whether it is struck with greater or less force.

A. In order that we may rightly view the effects exercised by a string that is struck, upon a string that is tuned alike, and at rest, it will be best to choose a particular case upon which we may fix our thoughts. Let us then imagine that the string which is struck retreats from us during the first vibration, and that the string at rest lies beyond it; in that case the air set in motion by the string that was struck will give a shock to the string at rest, by which it will be slightly curved, and cause a vibration through a very small space, but in exactly the same length of time as the string which has been struck requires for its greater vibration. You can now easily pursue the matter still farther.

Directly after the first string has made its greatest deviation in the direction away from us, the other does the same; and directly after the first has returned towards us, the other will also make a corresponding vibration, not only on account of the vibration of the air, but also in consequence of its own curvature. The first will now again retreat, the other will directly afterwards do the same, and this partly by its own vibrating power and partly by the influence exercised upon it. Hence it follows that it now traverses a greater space of vibration than the first time, and again retreats with the same force. This is repeated successively, so that the string which was before at rest now makes such great vibrations that the ear is sensible of the tremblings it communicates to the air.

S. I understand. The accompanying sounding string receives a fresh impulse exactly each time that it would naturally return in accordance with its own tension, consequently at the moment most favourable to increase its own movement. But if it had received a stronger or weaker tension than the other string, it would not have kept time with it, but have often run contrary to the shock, and thus have lost instead of gaining in oscillation.

A. Perfectly right; and the same is applicable to other things that produce tones. If we hold a tuning-fork when it is struck, opposite the mouth of a straight pipe, it will by its influence either produce the same tones as if the pipe were blown into, or none at all. In order to try this we can so contrive that the pipe will admit of being shortened or lengthened, and thus we can every time give it the length we desire.

S. But cannot a string be made to sound by means of another, which is not tuned alike, if it only be in a certain degree in harmony with it.

A. Certainly; and this again applies to sonorous bodies in general, on this ground, that the same body can either oscillate as a whole or be caused to oscillate in such a manner, that it is thereby divided into two, three, or more oscillating parts. If, for instance, a sounding tuning-fork be held before a pipe, whose column of air, if we blew the lowest tone upon it, would oscillate just three times as slowly as the tuning-fork, this column of air would then divide itself into three equally great divisions, each of which would vibrate three times as quickly as the whole, and consequently just as quick

as the tuning-fork which has been employed. An effect somewhat similar to this also takes place with strings. A string cannot only divide itself into certain equally great oscillating parts, but it can also at the same time vibrate as a whole. I hope that these indications will satisfy you, as a more circumstantial explanation would lead us away from our subject.

S. I think I can now perfectly comprehend the matter; but permit me still to follow up my idea of the sympathy of strings. It is not sufficient for me, that strings and other bodies which have the power to produce tones, are set into a sounding motion by tone-givers which are tuned alike, or at least in harmony. It appears to me also, that those bodies, which are set in tone-giving oscillations by other bodies, must again support them in their oscillations, but that, on the other hand, those which are only set in irregular oscillations thereby, must influence them in a disturbing manner.

A. Certainly; so far as a reactionary influence is perceptible, but this effect is generally too feeble to be perceived.

S. It is the same with these as with human sympathies: souls which harmonize together, reciprocally support each others' thoughts and feelings; minds with opposite dispositions influence each other in a hindering and disturbing manner.

H. But is this similarity more than merely accidental? What an immense distance there lies between the living and varied nature of man and a sounding string!

A. What an immense distance between a stone fastened to a cord, which a boy swings round, and those celestial bodies that move in a revolving circulation to all eternity! and yet science shows that there is a close alliance between these two movements. You know that we are not now treating of mere suppositions, but of a certain knowledge.

H. Far be it from me to deny this; but it can only serve as a comparison, which cautions us against too hasty a condemnation.

A. So far I must allow you to be perfectly right, nor did I aim at more; but the essential similarity is apparent, viz., that although the powers by which human beings influence each other, are extremely different from that of the strings, yet they must aid each other's inward activity by agreement, and encroach in a disturbing manner by disagreement.

H. Yet the activity of man is often strengthened by resistance!

A. Undeniably; but this would only serve as an objection if we asserted that the law of harmony was the only one for our inward activity. Every law may be concealed from immediate observation by the action not appearing by itself alone, but mingled with many others which obey different laws. In this I think consists the reason why the discovery of nature's most simple laws always has, and still continues to proceed so slowly.

S. But are all sympathies of the nature you have here pointed out?

A. As it is understood that we are here only speaking of the real sympathies, and not about the far more numerous ones which only exist in the imagination of men, I may venture to answer your question in the affirmative; which I therefore understand as follows,—that in those cases where well-considered experiences show that a connection subsists between effects which appear to us without any reciprocal combination, this must only be ascribed to our ignorance, and the connection must depend on hitherto undiscovered natural laws. I am well aware that I have spoken here of what is self-evident, but when we speak of things which are generally difficult of comprehension, this is not the worst that can happen.

H. I fear that by penetrating deeply into the examination of sympathies, we shall deviate too widely from our subject.

A. Certainly; for we have still an extensive field before us; but the little we have here said about it, cannot be without some sympathy with what we have undertaken to discuss.

S. I am glad to find that we shall not pursue this matter further, for I now long to put another question: Are not the nerves caused to vibrate in the same manner as the strings?

A. If you mean by your question, that they have a distant similarity with one another, I answer *yes*; otherwise, I must say *no*. The nerves are not extended strings, or tone-giving bodies. How those impressions are constituted; which they receive from the air that has been set in motion by the vibrations of tones, is unknown to us; but so much we know, that the nerves of the ear do receive impressions from it. What we know most accurately concerning these vibrations, is that they produce a series of pressures, and cessation of pressures. That the cessation of pressure is accompanied by a self-activity, and that it consequently is something more

than a mere cessation, we have the strongest grounds to admit; for if the pressure produce ever so slight an effect on the nerves, a change immediately takes place in them, which cannot be an enduring state, but upon which an endeavour must follow, on the part of the nerves, to return to their usual condition.

S. But such a result proceeding from the disturbance and restoration of its natural condition would however be a sort of state of vibration.

A. It was precisely on this account that I formerly said that, in a certain signification of the word, I must allow you both to be in the right. I may now add, that the compression which is produced by every pressure is accompanied by a development of heat, and the return to its former condition is accompanied by an equal degree of cold. It is true this is only proved by experiments on inanimate bodies; but the nature of the case scarcely admits of any doubt that the same, or at least an endeavour after the same, controlled by other effects, must also take place in the living body; for it is certain indeed that a peculiar co-operation of laws predominates here: yet these laws cannot destroy the universal laws of Nature, although they may more or less escape from our observation.

S. Our ears, however, are not sensible of such alterations of heat and cold, while we receive the impression of tones.

A. Just as little as we are sensible of each separate pressure which the trembling string communicates to the air, and this again to our ears. These changes succeed each other so rapidly, that we are not sensible of each separate pressure, but only of a wholeness of impression, if I may say so.

S. What a variety of secret impressions remain unknown to us, although they take place in our own bodies.

A. And yet I must name several more to you. The nerves have an extraordinary faculty of receiving electrical effects, and they permit these effects to pass through them with an almost inconceivable rapidity. Now as alternations of cold and heat are also accompanied by opposite electrical alternations, in which, although on an indescribably small scale, the same occurs which is so perceptible in the electric shock, we thus have a range of oscillations here exhibited, if possible,

still more mysterious than the previous ones. And I must again add, that every electric change is accompanied by a magnetic one; consequently this kind of change cannot be considered as excluded from the perception of hearing. I must now call your attention to something in connection with this, that appears to me worthy of notice. Light is produced by oscillations just as much as sound, only that the former is produced in æther, the latter in air. The effect which penetrates us while we are sensible of sound, is very closely related to light; it can be regarded, if I may so express myself, as another step of development in the natural effects by which light is produced. Much concerning these things lies within the limits of our knowledge; and of how many are we not ignorant?

S. You increase my astonishment at the variety, one might say the infinity, that lies in what we consider only as one perception. But with this you also increase my desire to learn still more.

A. As it can now no longer cause any misunderstanding, we will call the changes produced in us by tones, vibrations of the nerves. These certainly have their origin in the nerves of hearing, but thence distribute themselves to the brain, and from the brain to all the nerves that are subject to its rule.

S. I suppose it must be so. But will not the irregular effects produce vibrations of the nerves?

A. Undoubtedly; and it belongs besides to the nature of the activity of life that the body is incessantly thrown into a trembling motion by the most various vibrations and circulations. I name both together, for a circulation may be regarded as a vibration, which returns on a different path from what it set out; and the vibration may be regarded inversely as a gyration in a circle, which has been so elongated that its shorter diameter becomes inappreciable.

S. But why do such vibrations so necessarily belong to life?

A. You must first agree with me, that a complete state of repose is death.

S. Certainly! Without action there can be no life.

A. And if the action of a body is not content to constitute a portion of the universal life of nature, it must contain a

whole variety of movements, which could only be fulfilled within the body.

S. Ah, now I understand; these movements must constantly pass to and fro, if they are to remain within the body.

A. Just so. The circulation of the blood, the beatings of the pulse, and respiration, are well known examples of this. Again, in connection with respiration and the circulation of the blood, there exists a series of changes in the component parts of this liquid, whereby in its course it partly receives, and partly deposits certain portions, and undoubtedly with changing force, indeed also with a changing quality in the effect, since it is produced by changing pressure. In this manner the whole body is preserved by a series of forward and backward operations. The nerves and muscles participate in this preservation, consequently also in these oscillations.

S. But all these oscillations are very slow in comparison with the vibrations of tones.

A. Certainly! But we cannot doubt that vibrations also take place in the nerves, very different from those which are the natural result of what has been here stated. In observing the inward structure of the nerves, we easily discover a dissimilitude within them, in consequence of which every operation that passes through them must alternately find in certain parts a greater, and in others a smaller, resistance; consequently, every continuation of effects received must happen by a series of alternations.

W. Excuse me. You here seem to prove too much; for, as we everywhere meet with internal inequalities in bodies, which may be also seen under the microscope, we should in the same manner be obliged to admit similar internal alternations in innumerable operations, indeed almost everywhere in nature.

A. I by no means deny this; but we have been led to it by the peculiar nature of the thing. In the present day, we are unanimous in the admission of internal vibrations in light and heat, which indeed act incessantly in all bodies, nor can we deny their existence in the method by which electricity is propagated, whence it again follows, that they cannot be absent in magnetism, nay, not even in chemical effects. To go further into this matter would indeed lead us too far from

our aim ; but here I think it is sufficient, if we are convinced that the admission of an unspeakable variety of internal vibrations does not in any way stand at variance with those views which the discoveries of our age have led us to acknowledge. But I almost fear that I have made this matter too diffuse, and therefore wearisome to our friend Sophia.

S. You mean to say, that you fear I have not understood you. To this I must answer, that although several of the examples you mentioned contained something of which I was ignorant, yet I think I have comprehended enough of the whole connectedly, to enable me perfectly to follow up the subject. But in order to show you that I will not allow myself to be frightened by it, I will beg you to explain the difficulty which I first encountered in this matter. It appears to me, that such an immense number of vibrations must completely disturb, and even destroy one another.

A. I will explain the matter by some examples. If you throw several stones simultaneously into still water, you will see the circles which are thus produced, cross and recross one another in the most different ways, even momentarily in some places mingle together, but directly afterwards separate again into their previous form. At the various points where for several moments, the hills and valleys of waves meet together, neither elevation nor depression is seen: we might imagine, that the motion of the waves is here entirely effaced; but as soon as the movements necessary for their course through each other have elapsed, the mountains and valleys of waves again appear, each in its own position. All this shows us, that the pressure which produces the motion of the waves, may cross each other in the most different directions, without any sort of confusion being thereby produced. The distribution of sound itself, offers the most remarkable examples of the same crossing of the waves. What are elevations and depressions in the motion of the waves on the water, are condensation and rarefaction in the oscillations of the air. Now when you hear a number of simultaneous voices or sounds through a narrow opening in a wall or door, the oscillations of air necessary for the extension of light, must first have crossed one another in various ways in the narrow opening.

S. I perceive that the meeting of numerous oscillations, which you assumed in the nervous system, is not an excep-

tion from the usual mode of operation in nature, but belongs to her universal laws. I am therefore now much more anxious to hear how you can explain, that some of the vibrations which affect our nerves produce pleasant sensations, others, on the contrary, unpleasant ones.

A. Permit me to begin with a figurative representation. Let us imagine a quiet lake, whose smooth surface is ruffled by no wind, and where everything is still. If we now bestow upon it, for one moment, life, feeling, and thought, with the previous conviction that this repose does not succeed any violent commotion, would it not in this situation far less perceive and enjoy life, than if there had been some previous motion in it? Would it not, on the other hand, feel its life more complete and more powerful, if it were set in motion by gentle breezes, which disturbed the equilibrium of its parts so slightly that, after a short interval, it could itself resume this equilibrium, as often as it was disturbed? But would it not, on the contrary, feel itself overwhelmed and disturbed, if struggling winds incessantly altered the position of its parts, without allowing it time to pursue its internal efforts to obtain an equilibrium.

S. I understand you. We lent somewhat of our own being to an object totally different from us, in order to see the reflection of it within. The lake represents our inner nature, which feels its own condition, and prefers a determined, regulated series of movements, or a perfect stillness, to an irregular variety of motion. The waves of tone produce the proper regulated agitation in the too quiet lake.

A. We naturally do not understand this figurative way of speaking so literally as to suppose a perfect inactivity and stagnation in our own inward life.

S. That is self-evident; but should the inward activity be too feeble, and, if I may so express myself, should it be beneath the right and natural proportion in life, it may easily appear to us to be a stagnation. I now perceive that tones may draw us out of this state; but, on the other hand, it appears to me that if the inward movements are already too great, that tones must increase the disturbance.

A. We certainly cannot expect any diminution in the inward movements to be the first and most immediate effect of tones; but if we are full of that disquiet and confusion

within that results from a variety of irregular movements, should not music exercise a regulating effect?

S. So it appears to me.

A. But what music do you think has the greatest power to restore quiet and order to the troubled inner nature?

S. Choral music, no doubt. But I confess that I cannot see why; indeed, I now feel that I do not clearly understand the difference between this and other kinds of music.

A. Perhaps the difference will appear most distinctly if we first take into consideration the particular kind of music which of all others is the most dissimilar.

S. Which is that?

A. Do you know any music that consists of time alone?

S. I do not know exactly how to answer you.

A. When a drum is beaten is not the same tone produced at every stroke?

S. Certainly.

A. The music which is hereby produced cannot, then, derive its effect from a succession of tones, but merely by the manner in which we allow quicker and slower beats to succeed each other. Now, since we call the order in which we allow sounds of unequal duration and strength to succeed one another rhythm or time, we must consequently give the name of time-music to that kind of music which is produced on a drum.

S. I now perceive wherein choral music differs from it. Time in that does not play an important part; I mean to say that its character does not depend upon it; so that the beauty and effect of this kind of music proceeds from the manner in which the higher and deeper tones are united. Hence it is essentially tone-music. Time-music and tone-music are, therefore, the two kinds of music which are most distant from each other, and between them lie all those in which both are united.

A. Let us now first consider the effects of time-music. It calls forth regular movements. How much it facilitates the regular march of soldiers; no other music is necessary for dancing than time-music, although a mixed music, in which the necessary time for the dance is observed, is more agreeable. On the other hand we shall not find ourselves easily tempted to dance to the sound of choral music.

S. All this is true, but I do not see the reason of this difference.

A. The vibrations of tones, as you are aware, occur so rapidly, so many succeed one another every second, that none of our voluntary movements at all approach them. Whereas time-movements occur with far less rapidity, so that our voluntary movements can generally follow them. If we now consider that it is the activity of the nerves which sets the muscles in motion, we easily perceive that that series of strong alternations which the succession of time in the tones produces on the nerves may influence our walking and other voluntary movements.

S. Nothing seems more probable ; but I should like to have this explained by examples, in which the mode of action might be rendered visible.

A. We will begin with the manner in which man walks. Nature herself has regulated it sufficiently for common use ; one step is similar to another, and each is of equal duration, so long as we do not determine or allow ourselves to be determined on a change. An equal degree of progress, with unvaried thought, and unchanged exterior influences, would be the strictest regularity we could conceive. But this uniformity is too much for us, and is fatiguing, especially if our attention is only turned to the process of walking ; so that thought is fixed on the process of walking as the nearest object in view. If we now hear a regulated series of sounds where those of equal duration return after determined but short intervals, the nerves are placed in accordant vibrations, which appear to pass thence to the muscles of motion. The pace becomes more animated. I must repeat that I here only speak of those cases where the process of walking is the chief object of attention. This is particularly the case where many persons walk together. We may also add that the long-continued repetition of various irregular sounds, which in this case are produced, must cause the most unpleasant confusion. When, on the other hand, the process of walking is not the chief object, and still less in accordance with the walk of others, we resign ourselves to the greatest variety of impressions, which, in their rapidity, produce all sorts of changes. We have no strong motive to regulate them more exactly ; but if in the meanwhile we hear a series of sounds preserving a time suitable to our pace in walking, with or without alter-

nations in the tones, it generally influences our ~~pace~~. Such is my view of the matter ; but I have explained it with ~~some~~ timidity, because I feel that I have done nothing but express what lies within our daily experience.

S. Do not let that vex you. We so often allow experiences to pass by us without our retaining them, that we must have a feeling of satisfaction when we place them before us in their connexion. If I now understand you rightly, time-music regulates voluntary movements, and tone-music regulates the movements of the soul.

A. You have certainly here described that which especially forms their chief qualities ; but the former is not confined to the regulation of voluntary movements, nor is the latter quite excluded from having a regulating influence on them.

S. I feel that I overlooked much. How often have I not myself experienced the influence of time-music on the mind ; sometimes to soothe it, and sometimes to enliven it ! And how often do we not facilitate an enumeration or calculation of names by executing it in time !

A. And versification itself depends on time ; for although our language does not permit of that kind of verse which depends on the length of syllables, yet we receive a series of impressions corresponding to time by the well-arranged succession of syllables more or less accentuated.

S. But you said that tone-music is not entirely incapable of influencing motion. On what do you found this ?

A. Although the velocity in the vibration of a single tone is much too rapid for our voluntary movements to be able to follow it, yet the succession of tones in a melody contains a regulated rising and falling—a motion similar to the waves—which first acts on our minds, but thence can again exercise an influence on our voluntary movements, which is directed in so many ways, according to the disposition of our minds. Therefore I cannot doubt that if some one, during one of these solitary wanderings, where a man is quite lost in himself, and forgets all external things, either sung or repeated to himself, in his quiet thought, the tune of “ *Awake, my soul, and with the sun,* ” he would move unconsciously very differently than if the tune which he repeated to himself had been “ *The Lord my pasture shall prepare.* ” If we hear the sound of choral music when we follow a funeral procession, or perform any other solemn act, it appears evident to me that the music

has an influence over our pace in walking. At all events it is certain that simple tone-music has neither an equally great nor a similar influence on our voluntary movements as time-music.

S. Although I may seem to interrupt the explanations you are giving me about so many objects that were not clear to me before, still there is one difficulty which continually disturbs me during our conversation: you have certainly shown that tones must act on the nervous system, but it does not therefore appear to me that they must also act upon the soul.

A. If I thought that by this you required an explanation of the connexion that subsists between the spiritual and the material, I would not venture on an answer; but I presume that you will be satisfied with what I can give, which is indeed but little. We consider it, therefore, as understood, that whatever happens in the external world only reaches our spiritual self-conscious being by sensations which are awakened in the nerves.

S. I have heard that explained by Waldemar, which has clearly proved to me that without nerves there can be no sensations.

A. But our thinking being reacts on the nerves.

S. I am aware of that; the movements which are determined by the soul are fulfilled by the nerves in the body.

A. Yet you certainly do not regard these movements as the only ones?

S. I do not know exactly how to answer.

A. With all this, it must be well known to you that the body may either be refreshed, or it suffers by what takes place in our thinking being; that a happy frame of mind may drive away the evils attending the body, or may increase its well-being; and that sorrow may cause the opposite effect; nay, that the passions especially exercise a powerful influence on our bodily health. Where the activity of the mind does not extend beyond the natural measure of strength, it appears to prolong life; on the contrary, that exertion of the mind called forth by exterior influences or immoderate desires, acts, as is well known, in a prejudicial manner on the body.

S. You are right; all these things are well known; but I do not clearly see their application.

A. The impression which is made on us by strong passions,

by great and long-continued mental exertions, and in a remarkable degree, by strong external influences, is produced with less power by the weaker active forces, although they are not on that account imperceptible to the observer. Every action that is thus called forth in the nerves strives to prolong itself, and if continued in a one-sided manner, may lead to the utmost lassitude; but, mingled with a variety of others, it may produce upon us a more or less annoying disquiet, which is principally felt by a want of inward repose, a desire after what might be called a spiritual calm.

S. That is true. Who has not frequently experienced this!

A. It is then evident that our spiritual being incessantly produces peculiar conditions in the nervous system; and we have already seen, inversely, that the condition of the nervous system is felt by our spiritual being. Now, if anything produces a change in the nervous system which would be agreeable to the rational being within us, if it could be aware of its own present need, ought not that to afford us the most delightful enjoyment. Imagine our spiritual being, after it is inwardly connected with our body, tossed hither and thither in the various relations of life, about to lose itself therein. And let us suppose an excellent piece of choral music, which concealed the most charming harmonies of thought, were to set the nerves in a series of regular vibrations,—would not then this soul-body, lately so disturbed and confused (by one of its names alone we dare not here designate the recipient being,) be hereby led to a regulated, reasonable activity? Must not this feeling of inward harmony, so free from effort, and which relieves the previous anxiety and disturbance, seem a high and heavenly rest?

S. It appears that you will not grant this effect to any music but the simple tone-music?

A. I did not, however, mean this. I only took the least intricate example first. It is true that this less complicated music, in consequence of its nature, has a peculiar power to dissolve our inward disturbance; but this quality is not excluded from the music which combines both kinds, nor is music confined alone to this aim. What an extensive sphere of action stands open to the more varied means of combined music! Far be it from me to make any attempt to determine the limits of either of these species of activity.

The purpose of our conversation does not require it, and it is fortunate for me, since my limited knowledge would be quite inadequate to the task.

S. Nor should I, perhaps, be able to follow you much further; for, I am sorry to say, I have never pursued music to any great depth, though I have always been fond of it. Some blame, perhaps, may be attached to the method of instruction pursued. For it appears to me that I should have learned more, if I had not been taught what far surpassed my powers, and the time that I was able to bestow on it.

A. I am much inclined to believe that this is often an obstacle to a desirable progress. Music is so connected with our nature that all ought to be led to enjoy it, as much as the development and application of the other powers of the mind will permit it. Perhaps preparations ought to be made long before it is usual to give instruction in music. We might exercise children early, and generally during playtime, by moving, counting, reciting, &c., in time. We might certainly also teach most children how to produce time-music, and bring the subject nearer to their understandings, by letting some of them dance, or perform other exercises accordingly, so that the performance might alternate among them. As many as possible might also be led to execute tone-music of a simple nature, and with instruments which are the most easily managed. I need hardly mention the desirableness of an inartificial instruction in singing, but which must not on that account be opposed to the rules of art. I am willing to allow that another method of proceeding may be far better adapted to form distinguished artists. But where there are traces of great talent we can always take the proper measures in sufficient time. I believe that, by a strange misunderstanding, the great claims which connoisseurs can now with justice make upon artists, are often principally regarded, at the commencement of instructive music, whilst nevertheless most people neither possess talents to become artists, nor can they make it the object of their lives. Instruction in music ought not to be pursued with most people beyond the cultivation of a feeling for tones and for taste, which can be acquired by a dedication of a moderate period of time; and there are very few who can be made with real benefit to do more than execute a piece of

music of a very simple kind. To lead them to perform what is beyond their natural talents, while they do not perhaps bring to perfection what is more suitable to their capacities, is a great waste of powers, yet this mistake is not only committed in the musical branch of education. But you still seem to have several questions to ask.

S. I do not remember any at this moment. I thank you for having answered my question so explicitly. When I have had time to think over the matter, I shall, perhaps, try your patience again, for you seem to have led me into a totally different mode of representation than what I received from the first conversation.

W. That is exactly what struck me with much surprise, but I was anxious not to interrupt the conversation. You have entirely altered the system, my dear friend.

A. I do not, however, think so.

W. Did you not assume that the Beautiful is Reason itself, as far as it is comprehended by the imagination?

A. I do not deny it.

W. But you now represent the effect of the Beautiful in the art of music as a bodily influence.

A. I can no more deny this than the other, and I do not know how an influence conveyed through the senses can be only spiritual.

W. You were a spiritualist in youth, and you are now a materialist. This seems an important change.

A. I was both a spiritualist and materialist then, as now.

W. You must explain this.

A. That is only a reasonable demand. But I foresee that it will lead us into an inquiry concerning the meaning of all our views of nature. I therefore propose that we do not continue our discourse this evening; it might be fatiguing to all, after such a long conversation.

S. But I am convinced that you have still much to tell us about the Beautiful, which I should be sorry to lose.

A. Do not be anxious with respect to that. If we are to continue our discussion on the Beautiful, we must consider how nature acts when she produces something which we call beautiful; and for this purpose it will be necessary first to form a clear conception to ourselves of the spiritual in nature. It has already become evident that we ought properly to have

derived our examination of the influence of tones on our movements, and in connection with this, on our frame of mind, from a deeper source. Yet I do not regret that it has so happened, as it will, perhaps, appear that in this manner we can best maintain a lively interest in the treatment of the whole matter, which might easily occupy most of the evenings we are able to pass together.

TWO CHAPTERS

ON THE

NATURAL PHILOSOPHY OF THE BEAUTIFUL.

I HAVE already presented the fundamental thoughts of the inquiries which are here communicated, in my dialogue on the origin of the pleasure we derive from tones, and I have repeated them on several occasions since, with some fresh hints and explanations. By this it will be seen, that the subject has engaged my attention for many years past, but I do not the less feel that both the present fragment, as well as the continuation which I hope to give, refer to a subject which has been so little elaborated, that it must remain very imperfect; and even if it should gain the approbation of those who are competent to judge, it must still be regarded as only a feeble commencement of an extensive series of researches, which cannot be completed by any one person.

I.

§ 1. WHEN we make mathematical figures and formulas for the use of science, we produce something which bears an acknowledged stamp of beauty. The same, though in a much higher degree, occurs in our experiments for the discovery of the laws of nature. These facts, concerning two different branches of science, might appear at a hasty glance to have but a slight connection in common, but upon a closer investigation, we perceive that they are on the contrary very intimately connected, and that the explanation of this matter must be reckoned among the tasks of natural science. In an attempt to solve this problem, the importance of natural science for general education, which is becoming more and more acknowledged, will appear in a still stronger light; and though the first experiment may be far from satisfactory, it will, nevertheless, have pointed out an important task to be performed for the sake of higher culture, which can no longer be delayed.

§ 2. Our inquiry does not commence with determining the

nature of beauty; but, pursuant to the proceedings of experimental skill, we must search and investigate the laws by which something is produced, which satisfies the sense of beauty. It is evident that we must begin with those objects which can be most easily penetrated, namely, mathematical figures; but beauty in these is so simple, so little developed, so elementary, if we may venture to use this expression, that to many we might seem to be searching for beauty where it does not exist. The method in which we proceed with our continued inquiry must justify us from such a contradiction. We must limit ourselves here to answer provisionally, that, in daily speech, the most simple forms which agree with good taste are not called beautiful, unless they are placed in direct opposition with something ugly; just as the most simple and generally received truths are not distinguished as being reasonable, if no contrast demands it.

§ 3. Every one must feel, that lines and figures which express thought, the straight line, the circle, and figures formed of straight lines of equal size, are pleasing to the eye; but this is felt most strongly and decidedly when they are compared with careless scribbled strokes.

§ 4. We need only observe with accuracy this mental experience, to be convinced that the greater satisfaction we derive from the contemplation of figures which express thoughts, is not produced by thinking, but is connected with the direct apprehension of the thing. It is an inward sensational apprehension, a mental perception. We are not astonished to find this harmony between reason and sense, as they both spring from the same high origin.

§ 5. Every apparent object, however simple, contains a variety (we may almost say, an infinity) of thoughts, which thought must elaborate by separation, union, and arrangement, before it can grasp it in its oneness. Perception, on the other hand, receives an impression from it as oneness, and therefore complete, strong, and clear; but not with the penetrating consciousness of the inward nature of the thing, similar to what is produced by thought.

§ 6. When we represent a mathematical line or figure, whether it is only for inward perception, or also for the outer sense, we let ourselves be determined by a thought, without at the moment turning our attention to its development; but that which is represented, nevertheless, contains the expression

of all the thoughts which have been elicited during the development. While we represent the straight line, our thought is merely turned to the oneness of the direction. But if, on the contrary, we submit that which is represented to reflection, it is manifest that there is a similarity of each part, even the smallest, with the whole; the capability of an infinite prolongation; simple, unconnected motion; the shortest distance between two points; the fundamental measure for all extension. But it is sufficient to have pointed out the inward variety of the straight line. Since brevity, which must be our law here, will not allow us more than *one* circumstantial explanation of this kind, we will select an object which offers a simple and abundant cause for the development of thought.

§ 7. All know that the circle may be described as a line which is everywhere equally distant from a given point. It is also well known, what a variety of properties have been discovered in this figure by geometry. Among these is its infinite symmetry. To which ever part of the circumference we may turn our attention, a perfectly corresponding part may be presented exactly opposite; every line which passes through the centre of the circle, divides it into two perfectly equal parts; two diameters divide it into two corresponding portions; nowhere can a line be drawn without the possibility of drawing another in exact correspondence in an opposite position. We further see, that the arch is the measure for the inclination of the radii; that the circumference is infinitely divided, but at every point in a similar manner; and that it incloses a greater surface than any other line. This enumeration, incomplete as it is, will be sufficient to lead our attention to the copious thoughts which are expressed in the circle.

§ 8. Geometry, as is known, proves that these properties are not accidentally collected into the circle, but are the necessary result of its fundamental determination; that the distances of the circumference from the centre, must be everywhere equally great. This necessary connection will not however be deduced from the fundamental thought without the aid of perception, so that we cannot exactly say that the other thoughts lie in the fundamental thought, but rather that they belong to it. Were we to begin with any one of the properties of the circle, we might from it, though frequently with the greatest difficulty, arrive at all the rest. It

is therefore hardly possible to find an expression which would represent a thought of which we could say, that all those thoughts were contained in it; but we have a perfect knowledge that the circle, which is apprehended by intuitive perception, constitutes a oneness of thought. When the apprehension of reason appropriates this oneness of thought which is expressed in the perception, we have the idea of the thing. And in general terms we may say, the idea of a thing is the oneness of thought expressed in it, when apprehended by reason, though as a perception. We therefore cannot of course possess the idea without preparatory thought, nor without the comprehension of the thought in the perception. The impossibility of expressing the idea by a simple expression, does not prevent our having a clear apprehension; but it requires a higher mental exercise than the apprehension of usual scientific conceptions.

§ 9. Now although we cannot apprehend ideas, as ideas, without the exercise of reason, yet the presence of ideas is felt in perception, which is understood by the common origin of rational and perceptive nature. (§ 4.) This mode of understanding it, is however only a general apprehension of the case. We must show *how* it is in what follows.

§ 10. The beautiful, consequently, is the idea expressed in the thing, in proportion as it is exhibited to the perception.

§ 11. The idea is a oneness, containing a rich variety, which is not accidental, but has its being in the peculiar development of the idea. We express the same thing only in other words, when we call this a self-development, and when we see in it a self-legislation, in which, consequently, freedom and determination are united, therefore character.

§ 12. Symmetry alone, which represents no other thought but symmetry, is sufficient to satisfy the sense of beauty. The figure \mathfrak{G} by no means satisfies the eye, whereas the figure \mathfrak{G}_3 produces a pleasing impression. One part of the figure is not a mere repetition of the other, but its antitype, as it were; the object, and its reflection. The one half is the same as the other, but in the form of opposites. We here see the same opposition as between the thought of the thinking being, and thought viewed as something that is thought. Opposites, and union of opposites. Thus the fundamental form of thought meets our perception in symmetry.*

* We can produce many symmetrical figures of different kinds, by

§ 13. The symmetry we here speak of is of the most simple kind. Besides this first order of symmetry, there are many higher and more involved symmetries. Among these may be reckoned the position of the leaves of many plants. In the leaves which are placed opposite to one another, we see symmetry of the first order; those growing alternately, whose stalks preserve nearly the same perpendicular plane, belong already to a more composite order; the alternations, however, frequently do not occur in the same plane, but the positions of the leaves must have accomplished a circular path before an opposition is completed. We know that the number of the leaves which belong to such circular paths, is in many cases very determined, and that it only depends on our want of perfect knowledge if we do not always detect it.

§ 14. In every figure which otherwise expresses an entire thought, the symmetry is subordinate to the whole, or, more correctly speaking, is so interwoven with it, that it does not indeed appear as if it were independent, but it does not on that account lose its great signification; it reveals to us the inward harmony of the idea, which itself represents the harmony of reason.

§ 15. It will now be easily understood, that a figure which certainly represents a thought, but with an arbitrary addition, does not satisfy our sense of beauty; the inward harmony is disturbed by it, as, for instance, in the completely inequilateral triangle; on the other hand, another thought which still admits of symmetry, may be inoculated into the fundamental thought, which may be seen, among other instances, in the isosceles triangle.

§ 16. After this glance into the idea of the beautiful, so far as it can be developed by the contemplation of the most simple forms, it will be necessary to return once more to the circle, and to represent its properties in expressions which most nearly point to the idea of the same; in this manner we carry our example as near as it is in our power to that which doubling a piece of paper, and describing some arbitrary strokes along the folded line; for instance, a name, which we prick on the paper with a needle, without unfolding it. If we afterwards unfold it, we see, within, a symmetrical figure on both sides of the fold. The impression is somewhat disturbed by the circumstance that the little holes have elevated borders on one side; but the inequality is easily removed by a very sharp knife. On that side where the folded lines are elevated, we see the same thing, but the strokes of the pen have here a disturbing influence.

cannot be expressed. If we first proceed from the centre, we obtain the most perfect representation on a plane, of an expression of activity tending towards all sides, and checked in no direction. If we pursue a point which passes along the circumference, we see an infinite oneness in an infinite change. If we view the relation between its inward and outward condition, we find that its contents are greater than, with unchanged extent of boundary, could possibly exist in any other form. If we regard the development of the thought, we have an inward symmetry with the most entire absence of all opposites. It appears in such oneness, so defined, with such completeness and inward harmony, that it represents to us a little definite world, an image of the world, so far as this can be given on a plane, and with such simple means; we might say, that it is the most elementary image of the world. The ancients justly called it the most perfect of all figures (on a plane surface, of course).

If we compare the circle, as it appears amidst the union of the forces of the world, with the higher developed forms of beauty, then it remains faint; but if, as is requisite, we keep thought apart from all that variety, and permit the circle to dwell in the region of thought which we have separated for the benefit of our first contemplation, our views will find assent.

§ 17. Nature frequently produces the same forms as those which have been framed by our thoughts. In crystals, nature exhibits those forms which are bounded by lines and planes; the circle is displayed in waves; the parabola in the fountain; the hyperbola in Chladni's acoustic figures, and so on. In this manner we again meet, in nature, with what was created by our own thought; what were thoughts within us, are, without us, laws of nature. We become most perfectly convinced of this, by a universal contemplation of the whole of natural science. It is there shown, that the laws of nature are the laws of reason, that indeed the whole of nature is the revelation of eternal living reason.*

* I have endeavoured to represent this in my introduction to *Natural Philosophy* (Copenhagen, 1811), of which there is an improved translation in Schweigger's *Journal* for 1822, vol. 36, p. 458. One of the chief points in proof of the above is, that we are able, by thought, to deduce from known laws of nature, others, which are actually again found by experience; and that if this does not occur, we generally discover in what manner we have drawn a false conclusion. Hence we perceive, that the same laws of thought, by which we have made our conclusions, also prevail in nature.

§ 18. Nature, however, does not confine herself to the production of mere mathematical forms. She adds far more. How this happens, and how this acts, we will consider, in some of the instances which appear to us most easy of comprehension.

§ 19. If we throw a stone into still water, and follow with our eye the circle of waves which is produced, the impression at once teaches us that we have not alone to do with mere circles, but that these are exhibited to us in a concentric progress of elevations and depressions. We have not passive but moving forms before us. A closer investigation shows us that the portions move in their own circular path, or in vibrations, so that what meets the eye is the result of innumerable inward movements. The same investigation also shows, that all these happen according to universal laws of nature.

§ 20. But to this we must add the co-operation of the rest of nature with those effects which are merely the consequence of the expansion of movements. It is a light, as it were, beaming in from the rest of nature. The brightness in the expanse of water, the variety of light and shadow in the portions of the waves, the play of colour produced by the motion, give a life and completeness to the whole, which was wanting in mathematical figures. This variety, added to the original effect, must not be compared with that with which an object is often arbitrarily adorned. It belongs to the connection of reason peculiar to nature, that there is a higher unity in all these effects, which nature thus combines.

The question why all nature is not beautiful obtrudes itself here, but its answer must be postponed to the continuation of the researches.

§ 21. A still greater variety arises from the mutual crossings of the circles of the waves; where elevated circles of waves cross each other, a greater elevation is produced; and where depressed circles meet, a greater depression ensues; but where depression encounters elevation, a balance is perceived. These may often please us by a great variety, when, nevertheless, the arrangement is imperceptible. W. Weber has given an experiment in which a remarkable variety springs from one thought. An elliptical bowl is filled with quicksilver, and a succession of drops of quicksilver are allowed to fall into one of the foci, by which a succession of

circular waves are formed. Where these hit the sides, they are repelled in such a manner that each wave-radius, after the repulsion, receives a direction towards the other focus. Thus by the repulsion a new centre is produced in the waves, so that now the surface is filled up with two perfectly similarly constituted systems of waves. By the intersection of these waves new curves are formed, replete with differences, yet with the clear stamp of *one* law. In this variety the unavoidable alternation of light and shadow brings with it a new variety, no less accordant with this law, and bearing the stamp of thought as strongly as the curves. A delineation certainly gives an instructive idea of this variety, but yet the sight of the activity itself is infinitely more beautiful; for the motion, and the consequent flashes of light, cannot be given by any delineation.

§ 22. Acoustic figures exhibit another remarkable agreement of natural effects, which, to the uninitiated, must appear infinitely various, while in reality they still derive their origin from one fundamental thought in nature. The plate which is strewed with dust, exhibits to the eye divisions and figures determined by law, consequently, forms with the stamp of thought. But it is only when the vibrations produce figures which are pleasing to the eye, that the ear is also gratified by the impressions which we receive from them through the air. The one sense thus also confirms the testimony of the other, with reference to the impression of beauty.

§ 23. The most simple laws by which the relations of tones affect us agreeably or disagreeably, are so well known, that I need only refer to them at present. Every one knows that only those relations of tones are agreeable which can be expressed by very small numbers, or by such greater ones as are composed from the smaller ones in a mode easy of comprehension. The same relations of tones are also those which are most easily comprehended and recognized by our senses; indeed, where it is a question of the meeting of very few tones, the ease of comprehension and the pleasure bestowed seem perfectly to coincide. It is no less well known that the order in which tones of unequal duration follow one another—that is to say, rhythm—obeys the most simple laws of numbers. But in the combinations of tones which are composed, where dissonances are employed, and where these are again resolved, we may venture to make the remark, in

general, that the commencement of the dissonances allows us to feel a want of totality which is supplied by the tones through which dissonances are resolved.*

§ 24. But when we have become convinced that certain thoughts and relations form the essence of the beauty of tones, it will then be justly demanded, that it should be rendered evident how it is that tones can produce such great effects on the senses. With regard to this, it must first be shown generally that certain harmonies may promote effects, and certain discords oppose them; it must afterwards be shown that this may be applied to the living being.

§ 25. It is well known that strings which yield similar tones when thrown into vibration, exhibit the remarkable condition, that if one of them be struck, the other, as if of its own accord, sounds with it; but that strings which produce different tones do not exhibit this condition, unless one, while it is subdivided into certain smaller sounding portions, should perhaps yield a harmony. We are not surprised that the vibrations in one string should awaken similar ones in the other; for the vibrating string causes the air, and all parts which are in connection with it, to tremble, and this may again affect the reposing string; but we are surprised that this communication is not exhibited when the strings yield a tone which would produce discord. The effects must occur in the one case as much as in the other. And such is the case; the effects do occur; but in the first instance, we have a series of effects in which the one part strengthens the other; in the last, on the contrary, they mutually destroy each other. Let us imagine two extended strings, which are similar in all respects; when they are curved, they will vibrate with equal velocity, even should they not be equally forcibly curved; for the greater the curve, so much the greater, indeed, is the moving force; but at the same time so much the longer is the path which each vibrating portion has to pass through. If, therefore, one of two such strings is struck, at

* As the fundamental principles of the relations between consonant and dissonant tones are treated in so many books of instructions, I have only alluded to them here. On the other hand, I would have willingly spoken of the comparison which my ingenious friend, C. S. Weiss, has instituted between the proportionate dimensions in crystals, and the relative conditions of harmonies (*Proceedings of the Academy of Berlin for 1818 and 1819*, pp. 227—241), if this could have been done at present, without entering too diffusely into crystallography.

each vibration it will give a blow in one direction to the air, and to the intermediate parts connecting the other strings, which shock will thus communicate itself to the other strings. By this means an extremely small vibration is produced in this string, but exactly of the same duration as that of the first; when thereupon the first makes a backward vibration, the other will also partly turn back, in consequence of its own tension, and the motion that it has thus received; partly it will receive a new impression, caused by the first, which will favour its motion, and so on. In this manner, a series of small vibrating blows are produced in the other string, which, taken separately, would not be sufficient to produce a tone recognizable to the ear, but whose whole sum is strong enough for the purpose. If, on the other hand, this accordance in the vibrations be lost, then the atmospheric blow proceeding from the first string will certainly call forth vibrations in the other; but these will occur in such a manner that they often encounter blows which go exactly against their motion, and therefore will arrest the action which has commenced, so that no important sum of effects is apparent.

All this is sufficiently well known, but was necessarily mentioned for the sake of the connection.

§ 26. This condition in the strings is unscientifically designated as sympathy; and science may very well admit this name, though not if it is to designate an incomprehensible, obscure force in nature. We cannot object to this name, because the effect appears to be one-sided; for the string which causes another to vibrate, itself receives from it counter-effects, by which, if ever so little, it is supported in its own vibrations, as its effects on what surrounds it are also supported by the other string. If, on the contrary, the other string is discordant, it will exercise a disturbing reaction on the vibrations of the first, equally feeble, indeed, but on that account by no means to be accounted as nothing. If the string had sensation, it would then feel its being and action elevated by the harmony of the other, and enfeebled and disturbed by its discord. In the first case, therefore, its feeling of life would be heightened, and it would on that account enjoy a happy satisfaction; in the latter case, it would be enfeebled, consequently dissatisfaction and discordance would be the result (antipathy).

§ 27. If we imagine a string set in tremulous motion by

various vibrations, which are excited in it from without, and discordant with its fundamental tones; and if it now receives the impression of another sounding body, which sets it in natural vibrations, then those non-harmonious motions will be partly removed from it, and be to a certain degree rendered comparatively feeble. If the string had sensation, it would feel itself delivered by this harmonious tone-vibration from a multitude of secret disturbing impressions, of which it is unconscious, and would rejoice in this deliverance and its own increased self-enjoyment.

§ 28. But can this be applied to man? The differences are indeed, in certain respects, wonderfully great; but if we turn away from the peculiarities in the vibrations of strings, and if we call each alternate transition from one condition to another in opposition to it, a vibration; then the whole of existence is penetrated by vibrations, and we are now aware that light and heat, equally with sound, depend upon them. Among those vibrations which occur in our own bodies, respiration and the beating of the pulse do not escape the attention of the most careless; but he who reflects more closely what important internal changes are connected with respiration and the movement of the blood, will not doubt that many hidden alternations must necessarily be the result. We will here consider the vibrations which exist in connection with the effects of tones. Every tone is produced by a series of tone-waves, and each of these makes an impression on the organ of hearing, which is followed by a retrograde movement; thus a series of compressions and expansions take place in the acoustic nerves; or if they cannot be so designated, a series of alternating opposite impressions. But still more changes result from these compressions and expansions. Every compression produces a development of heat, every expansion produces cold. In their rapid succession these effects are not felt as heat or cold; but none will easily doubt that conditions in the nerves correspond to this. Further, electrical changes are connected with these variations of temperature; and with these again, magnetic; and however small they may be, they cannot be unimportant.

§ 29. We have hitherto spoken of the acoustic nerve in general, but it would evidently be a great error to compare it with a single string. As a whole, it receives the impres-

sion of all tones ; but the ingenious development in this perceptive organ gives us reason to suppose that it contains subordinate parts for the apprehension of the different tones. Were any one to doubt this, he would still be compelled to grant that the ear bears the same relation to tones as a whole system of strings in which all tones find a consonance. Should any one, on the other hand, consider it too bold an idea, that the nerves, as it were, are consonant, this must either proceed because, contrary to express declaration, he instituted in our comprehension too close a comparison between the extended strings and the nerves, or because he overlooked the truth that every organ of sense must be itself capable of producing the impressions contained, or, if one would rather have it, has itself the power to repeat them. We might, on this occasion, point to the experience, that both the sensation of sight and hearing continue after the external cause is removed.

§ 30. By the impression which all external nature makes upon us, the acoustic nerve, and through this the whole nervous system, is in incessant vibrations, which are frequently so feeble that we are unconscious of them; but when we are alone in the silence of night, we shall distinctly feel that what we previously considered silence is no longer so; and yet even the deep silence of night is not an entire cessation of all tone-vibrations. In the uncertain vibratory condition of those nerves, the tones enter and produce a powerful active force, where formerly it was only a dormant one; and, along with it an order, a harmony, which suppresses the irregular movements, or makes them impracticable. But it will be advisable to explain these relations by examples. We will turn our attention to the process of walking, in man. Each step is the result of a new impression on the muscles of movement, proceeding from the nerves; and the process of walking presupposes vibrations of the nerves, in the signification which we before mentioned. (§ 28.) Now when neither the thinking will is in a direct manner turned on our walking, nor a ruling disposition exercises an indirect effect upon it, it will then show itself undetermined in so far as it does not bear the impression of strong habit. But should this man, during his undetermined walk, hear some music of marked time, for instance that of a drum, his walk will be regulated accordingly. The vibrations of the acoustic

nerve will be communicated to the whole system. In the same degree as a piece of music peculiarly derives its character from the relations of tone, and possesses no strongly marked tune, (rhythm,) it will have less direct influence on the movements of man, but more on the disposition of his mind, which has again greater or less influence upon motion. Should a wanderer who is not absorbed in any determined thoughts, hear significant choral music, he will certainly be thrown into a corresponding disposition of mind, which will not fail to influence his pace.

§ 31. It therefore appears, that if we station ourselves in external nature, for the contemplation of the impressions of tones, they must appear to belong wholly to the material world; if, on the contrary, we station ourselves in the world of thought, their whole nature seems to belong to this. But after we have accomplished this separation, both must be comprehended in *one*. The laws of nature in the material world, are laws of reason, revelations of a rational will; but when we thus consider all material nature, as the constant work of eternal reason, our contemplation cannot remain at this point, but leads us by thought to view the laws of the universal nature. In other words, soul and nature are one, seen from two different sides: thus we cease to wonder at their harmony.

II.

§ 32. Inasmuch as sound is produced by vibrations, which reach our ear through the air, so is light produced by vibrations, which reach our eye through æther, which is such a fine material that air in comparison with it is very thick and heavy.*

§ 33. Æther-vibrations, to produce the sensation of light, must have a certain velocity. If the velocity is either greater or less, the æther-vibrations produce no sensation of light, though they are not wholly inefficient. They give rise to several other processes, playing a most important part in the economy of nature, more especially heat

* Sound-vibrations may indeed occur in other bodies as well as air, but as it is peculiarly through this that they reach our ear, we only mention air in the comparisons which are made, here and in the sequel, between sound and light.

and chemical changes. The slower vibrations more especially cause heat-action, the quicker ones strong chemical action.

§ 34. In order to perceive the great importance of this, we must keep in view how the whole of the material world is penetrated by invisible movements, which determine the whole being of bodies in a far higher degree than we are accustomed to consider.

In such contemplations we must beware of being arrested or confounded by the illogical though somewhat natural thought from which but few can emancipate themselves, that the real nature of the material is a dead passive existence. The following, though only a hasty survey, will contribute to awaken the correct idea of this.

No one now doubts that heat is an inward vibratory movement; but by heat, also, the amount of space occupied by a body is determined, and the manner in which it fills this space. It depends on internal heat, whether this body shall exist in a solid, liquid, or gaseous condition; whether, therefore, it shall forcibly retain a determined figure, or shall yield to every pressure; whether it shall occupy a small space, or one many hundred or many thousand times greater. Let us now imagine that all bodies are incessantly agitated by rays of heat, that each moment they give and receive, and this not alone on the surface, but again within, between part and part, and we shall, even at a glance, perceive how the nature of the being belonging to a body, is determined by a constant, enduring, outward, and inward struggle, in which all apparent inaction is only an equipoise between the opposite and unextinguishable active forces, which is limited to certain periods.

But heat is not the only effect of these vibrations; the chemical, electrical, and magnetic condition of bodies, is also most intimately connected with it.

From the Sun proceeds the great active force, which especially maintains all this inner motion. It does not merely incessantly send to the earth actual Light-rays, (visible rays,) but likewise Heat-rays with their slower vibrations, and those rapidly vibrating rays which are alone distinguishable by chemical action. The manner in which all these effects resemble or differ from each other, is still disputed; but their intimate connection is not questioned.

§ 35. From all this it is easy to perceive, that light con-

tains the germ of that inexpressibly various inward activity, which is hidden to the immediate impression of the senses, and by which the whole of the material world is prevented from falling together. If it were possible for that agency to cease which is revealed to us by light, then all these inner movements, which depend upon opposites, would follow their tendency to equipoise, which would be the same as an inward passage to a state of rest, accompanied by a universal evanescence and ruin; and it would necessarily end in a universal state of inaction and death. Light is, therefore, a great revelation of the universal life of nature. Darkness also here receives its deeper signification. It may indeed be designated as an absence of light; but we now see that darkness cannot exist without the occurrence of an inner movement towards destruction and death. Our pleasure in light, and our dread of darkness, is most deeply founded in all this relative condition of light and darkness.

§ 36. If we only directed our thoughts to this deeper foundation, without uniting to it the perception of the effects on the senses, we should not understand how the whole relative condition might have appeared in the consciousness of the human race; but all this inner activity could not have existed without the testimony of the senses. We feel this in the arousing force exercised on us by light, and in the heat with which it penetrates us. All external nature shows us, by innumerable revelations, the same arousing, enlivening, fertilizing activity. There is, therefore, no gap between the manifold inward activity which is recognised through the thoughts, and the great and rich impression which light calls forth to our senses; they are only different expressions of the same thing. A keen sense of nature has, therefore, always placed light and life, darkness and death, in connection with each other. This was most strongly and beautifully expressed, in its fundamental features, in the lessons of Zoroaster. Even the connection in which he viewed light and virtue, darkness and evil, will be shown in the sequel to be something more than empty imagery. What has been created by the sense of nature, and what has been developed by the imagination, will, in the course of time, as thought extends her dominion, be driven back, till, by constant progress, thought reaches a point where it can decide either whether the imagination has guided the sense of nature on a false track, or whether the

first lively apprehension may be fundamentally justified as a true inspiration of nature.*

§ 37. By an action of the mind we are able to raise ourselves above the impression of grief and terror which is roused within us by darkness, and we can retreat to our own inward nature. We then feel ourselves withdrawn, by the removal of light, from the variety of different impressions which we are accustomed to receive from it, and can so much more freely allow ourselves to be governed by a mental activity which is directed towards the Infinite. Thus darkness is the mother of holy solemnity, but its father is the pure Spiritual contained in the world of light which can be destroyed by no darkness.

§ 38. It belongs wholly to the nature of the thing that we are unconscious of the action of light without an opposite impression. There is no consciousness of light without darkness. The pleasure we feel in the transition from a long period of darkness to light, is known to every one. Even the transition from a sky obscured by clouds has a cheering influence on every well-constituted mind. Our pleasure in light also forms an essential part of our feelings; in the contemplation of a starlit sky. The eye here receives the impression of points of light, each of which in its struggle with darkness exhibits an immeasurable power of light in proportion to its size. These clear lights overcome, indeed, the darkness in the expanse of heaven, but the earth lies dark and dead before us, and filled with the terror of darkness, while the eye receives light as it looks upwards towards heaven. This feeling seldom gains great force except in free nature, far from man and his works.

§ 39. It is easy to perceive that the satisfaction we feel in this belongs to a happy alternation of light and shade. In nature, where it is always conformable to law, it is indeed constantly correct, but not, therefore, always equally within the limits of our view. This capacity of being surveyed, this comprehensibility, is a necessary condition for our enjoyment (compare § 23). A circumstantial development of the doctrine of light and shadow might, perhaps, be demanded here; but such would be beyond our object, which does not aim at

* It must be understood, that the inspiration of nature is of divine origin, as is the whole of nature; but the appellation must be selected deliberately, according to its most immediate acceptation, not to mention that we must not be lavish of high-sounding words.

giving a practical theory of Beauty, but a statement of the primary laws of the Beautiful.

§ 40. As opposites in symmetry assist our perception in the comprehension of form, the opposites of light and darkness assist our perception of sensation. In symmetry we encounter the opposites of forms; in the relative conditions of light the opposites of effects. In symmetry we are more forcibly conscious of the sum of thoughts; in the apprehension of light, on the contrary, the feeling of the reality preponderates. But in this reality we feel the presence of a spiritual life. Just as in forms, far more is contained than the opposites of symmetry, so in light, far more exists than the opposites between growth (*werden*) and the return to nothing. Besides what we have already mentioned as arousing feeling, a whole world is unfolded to us in colours, which we will presently consider from a nearer point of view.

But in the infinitely rich development of light, the sum of Reality (the Real) is most prominent, while in the development of form the sum of thought (the Ideal) is most apparent.

A combination of a sum of thought and a feeling of reality is also apparent to the ear, but more intimately united; in other words, less apart, less unfolded and proved to our consciousness. The development of the spiritual could not be so perfect in a mind which almost limits itself within the form of time. It might, indeed, be said that sight most nearly belongs to the form of space; but in this comprehension by the senses, time always exercises an influence. It is only by the addition of speech that the ear receives a more varied function, but then it is especially in the service of thought.

§ 41. In order to arrive at a closer insight into the relation of surfaces to light, we must distinguish between the two ways in which they reflect the light they receive. Each point emitting light is, as such, the point of issue for a succession of æther-waves. Each straight line which can be drawn from this point perpendicularly upon the surface of the waves, marks the direction in which it acts, and is called a ray of light. Since the light which proceeds from a point and falls upon a surface, occupies a space in the form of a cone, that circumscribed segment of a collection of waves of light,—such an outwardly limited, but inwardly infinite collection of rays of light,—is called a cone of light, a cone of rays. If

the cone of rays falls upon a polished and flat surface, it is reflected in such a manner that all its rays retain their relative position, so that the eye receives this bent-back light, as if it proceeded from the point of light; only with this difference, that the eye, which is unaware of the change in the direction, imagines the point just as far behind the polished surface, as in reality it is before it. Even when the polished surface is not a plane, but has certain regular forms,—as, for example, the form of a sphere, of the paraboloid, of the hyperboloid, of the cone, of the cylinder, the rays are so reflected that those which reach the eye continue to belong to one common cone of rays, although its figure is more or less changed. It may be said that the cones of rays are here reflected undivided, although not unchanged.

It is well known that the surfaces which reflect the cone of rays undivided exhibit to us images of objects, or are mirrors. If the surface consists of various very small polished portions which are known to be separated from one another, still each of the little cones of rays which are reflected from such portions remains undivided. On consideration, we recognize in each of these small polished portions a mirror; but the surface, on the contrary, regarded as a whole, can now no longer be so named; we do not, however, on that account deny that it is polished. From each of the polished portions the light is reflected, according to the laws of reflection of mirrors; and we may therefore designate this, which is usually called regular reflection, by the name of mirror-reflection; by which means the object of perception is brought nearer. Inasmuch, on the other hand, as the rays which fall upon the surface are reflected back from the receiving portions, in all possible directions, the original cone of rays is, as far as this happens, dissolved: but it never happens completely. This reflection has been justly named *the dispersing*; but it would be better designated *the dividing*, by which means the inattentive would be prevented from confounding this with the extremely different scattered reflection which is caused by the convex mirror.

§ 42. The light which reaches our eye by mirror-reflection, gives us no notion of the reflected portions, but only of the presence of the light, and of the point which emits light, when the portions of the surface have a common situation suitable to it. By the dividing reflection, we re-

ceive, on the other hand, a knowledge of the reflecting parts themselves.

If there were a surface that merely produced mirror-reflection, it would not be seen, in the real sense of the word, although we should remark its presence by its mirror-reflecting action. To the direct sight, it would be as if it were not there. But on each mirror-reflecting surface, however perfect it may be, the light sustains also some dividing reflection, by which means it becomes the object of real sight. On the other hand, there are also no surfaces by which the received rays of light exclusively sustain the dividing reflection; but we call surfaces bright or dull according as the one or the other of the two kinds of reflection produce upon us the most remarkable impression.

§ 43. Just as unequally rapid vibrations in the air awaken in us the feeling of unequal tones, so unequally rapid æther-vibrations awaken within us different sensations of colours. The distance between two successive waves, both in the æther and in the air, is greater, according as the vibration is slower. This distance is called the breadth of the waves.

§ 44. Of all perceptible ætherial waves, those which produce the sensation of red, possess the greatest width of wave. Next to these are those which show only the red-yellow, or orange-colour; after these come, in the following order, those which produce the sensation of yellow, green, blue, and violet, of which the last has the least breadth of wave.

It is well known that the directions in which all perceptible æther-vibrations act are called rays of light, and according to the impression which they produce, we call them red, yellow, green, &c., although we attribute no colour to the æther-vibrations themselves. But for the sake of brevity, it is very convenient to speak of red, yellow, green, and other rays, or red, yellow, and green light, if a misunderstanding is only prevented.*

§ 45. The light transmitted to us from the sun contains a variety of rays of different colours. In as far as these are not

* Many object to the doctrine here brought forward, because they comprehend it as if it would prove that colours were nothing but vibrations in the æther, and do not consider that the sensation is something quite different from the external means of excitation. See, in the sequel, § 69 and § 70.

all reflected in the same mutual relation of number as they fall upon the surface, we receive the impressions of colour. No such change happens in reflection from a mirror, but only in the dividing reflection. Upon this depends the relation of colours to all surfaces, white and black included. A surface, whose rays, coming through a dividing reflection, all contain the same proportionate number of rays of colour as that which occurs in sunlight when the reflection happens immediately in a somewhat copious manner, is in that condition which we call white; if, on the other hand, a very small number are reflected, the surface is black. If there were a surface, where no dividing reflection took place, it would be ideally black, and not seen, but only visible to the eye by opposition to what surrounds it. If there were a surface, which by a dividing reflection restored all the rays it received, it would be ideally white.

§ 46. A portion of the rays which the surface has received always vanish by the dividing reflection. It is said of these vanished rays, that they are absorbed, which, however, is only intended as a figurative expression, by which one would denote that to the direct impression of the senses they have vanished, but which does not declare the mode of action which takes place.

§ 47. When the absorption through a surface does not affect all rays of colour in an equal proportion, but a preponderance of certain rays remains in the reflected light, a corresponding impression of colours is thence produced; if most of the yellow, orange, green, blue, and violet rays are absorbed, but only a few of the red, the surface is called red. Since no surface exclusively reflects one single kind of rays of colours, there is neither a perfect red, orange, yellow, green, blue, and violet surface, or a perfectly white or black one.

In the technical language of natural philosophy, neither white, which is the oneness of all colours, nor black, which is the want of it, are called colours. On the other hand, in consequence of the direct impression of the senses, white and black, as inequalities in the impression which is produced by the dividing reflection, are reckoned among the colours. It may sometimes be convenient to use the word in this more extensive signification, if no misunderstanding is thence caused.

§ 48. Materials which, in a very finely divided condition, exhibit a marked colour, (the word taken in its widest signification, § 47,) are employed for the purpose of covering the surfaces of other bodies, and are named, with respect to this, pigments. The circumstance that in daily life we have called them colours, has given occasion to many misunderstandings; we are too apt to forget, that they only produce a sensation for colour, since they absorb a great deal, indeed most of the light which is received. Even the white pigments only restore a part, although a very important part, of the received light.

Although science clearly proves, that pigments only give a feeble notion of the actual richness in the colour of light, most people still consider them as true colours; but they are by that means diverted from the right point of view, from which they ought to comprehend the splendour of colours. Nothing can contribute more to a correct sense of colours, than to become familiar with the development of colours in refractions, bendings, polarizations, &c. It is through these manifestations of the inward splendour of light, that we become first initiated into the enjoyment of light and colour.

§ 49. While we consider the effect which colours have upon us, we must distinguish between their effects on small surfaces, for instance, on flowers, and upon more extended surfaces, as on walls of rooms, carpets, dresses. It will be advisable to treat, first, of the greater surfaces. We shall occasionally feel ourselves called upon to distinguish again between surfaces confined by narrow limits, somewhat larger ones, and those which are very large, and widely extended, such as the blue heavens, the green surface of the earth, &c.

§ 50. White surfaces transmit to the eye far more light than coloured, which are distinguished from the white by this, that they absorb most of the rays of colour, and particularly because they only reflect one or a few kinds of it. White is therefore opposed to all colours in general, as the bright is to the dark. Besides the contrast between white and coloured surfaces is often diminished by this, that only a small preponderance of the distinguishing rays are reflected from the coloured surface, so that the white really prevails in it, which is also considered a bright colour.

§ 51. The most complete contrast naturally exists between white and black, as it does between light and darkness, which

has besides always been acknowledged. The ordinary sense of nature has taught man, from time immemorial, to discover an indication of innocence and purity in white. The pleasure we have in light, the removal of everything strange, the equilibrium, and the repose which lies in it, are felt by the senses, and recognized by science.

In the same manner, our sense of nature does not require the guidance of science to comprehend black as the colour of darkness, as well as that of mourning, since all the joy we find in light is excluded from it. Although, at different periods, and in different countries, other colours have been employed to indicate mourning—for example, the colour of the falling leaf—yet black is evidently the one destined by nature for that purpose. If this is doubted by any one, in order to remove his doubts, he should imagine himself placed in a room entirely hung with black; his sense of nature, which he cannot throw off, will declare the frame of mind which he must arrive at. It is not to be denied, that the impressions of memory and habit may also contribute to make black seem mournful to us; but that does not make it less certain, that, independently of all this, there is a strong natural foundation for the impression which we receive from black. The use of black in the dress of the clergy might be thus explained, that it keeps at a distance all distracting thoughts, all the feelings of joy in life which is united to details; but, on closer consideration, it leads us to thoughts of darkness, as the mother of solemnity, and awakens a sensation of it. (§ 37.) The use of black dresses, in circumstances when they are meant to indicate nothing, depends upon the mere absence of colour. If the thing is viewed on this side, it is only recommended, because its use serves to render inconspicuous what might not suitably appear in all cases where dress is appropriate. It thereby receives a certain general utility which real colours do not possess. The same universality belongs also to white. But the utility of both depends upon different conditions.

It must be remarked that, with regard to significance, we must distinguish between dull black and that which has a gloss on it. The first is the real clothing of darkness and of mourning, the last receives from its gloss an addition of light, by which the melancholy impression is more or less lost.

It is well known, that white is principally employed in the dress of women, and particularly for young people. Since the dress of men must be exposed to many changes of weather, and to a variety of work and occupation, we cannot easily use the material which otherwise would recommend itself, namely, that which can be easily washed and bleached; it must therefore be black, if it is to possess the requisite character of universality. By means of the gloss which we are now able to give to woollen materials, the degree of melancholy about them is removed as far as is thought requisite. White, when employed in dress, will not allow of any gloss, because without that it has sufficient light, and the gloss would therefore dazzle, and would besides make the forms less striking to the eye.

§ 52. The dress of women has a far greater surface, and conceals much more of the form than men's dress. It is, therefore, easy to understand, why the colour of the dress is of much greater importance with women than with men. Perhaps this is not the only reason, but if there were no other, it would be sufficient to establish a great difference.

§ 53. As black is not a colour adapted to the interior of houses, unless some particular object is aimed at, so neither is white suited to it. It yields too much light. Perfect snow-white would be almost unbearable.

When the earth is covered with snow, we have a great surface presented to us, which the eye can hardly endure, except under a feeble light,—for example, moonlight. The dazzling quality of snow is increased still more by its brightness.

§ 54. Red is produced by the greatest waves of light. The red light which is developed by the prism from the sun-light, also yields the greatest amount of heat. Experience shows that this light acts strongly upon the eye. Its colour is thus, according to circumstances, enlivening or disturbing, particularly the last, on widely extended surfaces. It is well known that certain animals are disturbed by this colour. Painters have always considered it as a warm colour to the eye. The discoveries of modern natural philosophy coincide in the declaration of this feeling. Mixed with white, as bright red, it is cheerful, without this dilution it is gorgeous. The same colour may, as Goethe says, be adapted to the gaiety of youth and the dignity of age. We have here only treated

of actual red. It will appear in its combination with other colours in what follows.*

§ 55. Orange is produced by waves of light of a somewhat less breadth than those of red. Its actual heat is also rather less; on the other hand, the light of the sun contains much more of it, so that the strength of its light is much greater. By this means it receives a greater activity, and the enlivening as well as the disturbing activity thence receives a greater significance, and allows it here to surpass the pure red. By different mixtures of red and orange many intermediate impressions may of course be produced, in which the arousing, the animating, the splendid, the disturbing, more or less prevails.

§ 56. Yellow again has a still less breadth of waves than the two preceding colours, but greater power of light, which is proved by measurements of light. It is clear, gay, and softly exciting. The experience of yellow walls, curtains, &c. sufficiently proves this impression. Its effect is more especially increased by polishing, which we learn from gold and by what we remark in shining stuffs. It is as if this colour, which produces the most light, were not able to exhibit itself in its full splendour without polish. Any contamination makes it disagreeable to the eye, which is also the case with white.

§ 57. Green stands halfway between the colours as regards the breadth of the waves, the effect of heat, and the power of light. This equilibrium gives it a peculiar repose, which makes green particularly suitable for a room which is daily occupied.

§ 58. Blue has, again, less breadth of waves, less warmth, less power of light, than the preceding colours. When surrounding us it makes a somewhat cold as well as dark impression upon us. But this may, of course, be diminished by the mixture of white.

§ 59. Violet, again, is inferior to blue in breadth of waves, in heat, and power of light. It strongly approaches darkness, and is for the most part very much mixed with white. Goethe finds something disturbing in it, but very justly

* I cite Goethe both here and in what I have further to say on the effect of colour, but I essentially differ from him in his theory. It will, besides, be quite evident how much I have had to add and to correct by the application of Natural Philosophy.

of a different sort from the exciting unquiet of the more active rays. It produces the disturbing influence of a want of something being missed.

§ 60. The unequal satisfaction which different people feel with the same colour, particularly in what surrounds them and in dress, we can easily understand, from the unequal tone of the nerves, in consequence of which some are particularly delighted with strong impressions, others with softer. Inasmuch as a person has selected the colour surrounding him solely from the impression which colours are accustomed to produce upon him, this choice will be connected with many of his other inclinations.

§ 61. Besides the impression which we receive from colours in consequence of their direct relations with light, there are others which are founded on their indirect relations.

Among these, those deserve particular attention which arise from such popular notions (associations of ideas) which connect the thought of a certain colour with the impression of strongly coloured objects in nature. They have a far greater significance than those combined notions which arise from many arbitrary determinations of social life.

Red reminds us of blood, which is one of the great sources of life in our bodies. Where its colour shines through the surface of the body, it shows health and strength of life. The exceptions which are conveyed by an unhealthy predominance of this colour do not prevent us from recognizing this principal impression. Among those races where the colour of the skin is black, and where, consequently, the relation between the colour of the skin and the colour of the blood is not so easily recognized, the apprehension of this subject must be different.

The same may be applied to many peculiar colours of the skin, in whole races of people; so that the intuitive perception here mentioned may belong in its totality to the whole Caucasian race. Orange reminds us of fire, green of the fields and woods, and thence of the firm surface of the earth contrasted with the sea. Blue reminds us of the sky, and not so essentially of the sea, which only receives its colour by reflection from the sky. It also reminds us of distance. Goethe says that blue is a stimulating negation. We learn from natural science that blue, united with violet, is reflected back every time that light passes through a less occupied

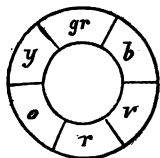
space, namely, a vacuum. That expression of Goethe's is, therefore, very well adapted to the nature of the thing, and to the recollections of nature which are called forth in us. Violet and blue also indicate darkness, since they are the colours containing the least light, and the pigments which they represent are easiest converted into black.

The symbolical meaning which is attributed to certain colours is also founded on nature, although more remotely, and not in all parts with equal foundation. We have spoken already, in § 50 and § 51, of white being the colour of innocence, and black of mourning. Their symbolical signification is most apparently founded on nature. Red, as a symbol of love, has probably received its meaning from the colour of the blood, with which is united our ideas of the heart, of heat, and of the intensity of life. Yellow is said to denote falsehood, for which I cannot so easily find a satisfactory reason, except that it indicates the deceitfulness of that which shines, which may also be justified by the facility with which yellow, when it departs from its purity, becomes disagreeable. That green should indicate hope, seems founded on the promising green of spring; if we only considered the satisfaction with which the eye can, as it were, rest upon it, we should rather call it the colour of trust: blue is called the colour of fidelity; but since faith, hope, and love are so frequently named together, and since each of the two last mentioned has its symbolical colour, it appears to me that we must also assume that one of the colours must likewise be applied to this noble quality. It is sufficiently evident that blue, since it indicates distance, vacuity from matter, therefore the immaterial, is suitable for a symbol of faith; but this apprehension is first properly introduced into the circle of our perception, when it is seen in the colour of the sky, and the thoughts of it first leads us away from the earthly. It is besides certain that faith and constancy are also denoted by blue, and we may have been led to think so by the repose in blue (§ 58), and by the feeling, that of all colours it is the least splendid, with the exception of violet, which, if we really speak of the actual violet of light, and do not confound it with a mixture of colours which contains more red in it than this, is such a feeble light, and has in consequence so little power, that when we speak of colours it is not much considered, and is seldom used. I believe, how-

ever, that many who have a delicate sense for colour, would agree in calling it the colour of earnest longing.

§ 62. Goethe says, that through a blue glass we see everything in a mournful light, and through red glass in a fearful light; but this assertion must be understood in a very limited sense. Through a blue glass, we see faces, trees, red roofs, &c., in a mournful light; because the red, yellow, and green light is almost taken away by the blue glass, so that the eye neither receives the preponderance of rays of colour which are contained in the light in order that the objects may proportionately send back their colour, nor the red, yellow, and green rays of colour which are contained in the unmixed light, that they reflect. We therefore behold the objects in an unnatural and feeble light; but that does not occur when we see blue objects through blue glass, such as the sky and the sea. The same method of observation may be applied to the view we obtain through other coloured glasses; for example, through red. Heaven and earth appear as if they were all on fire. This impression becomes still more terrible, because the red illumination being both very active and reflected from great surfaces, is disquieting; but if through such glasses we see objects which ought to be red, as the countenances of men, the impression is often cheerful and enlivening.

§ 63. It has been proved by numerous experiments, that certain rays of colour form, in their combination, white. The accompanying figure will best illustrate which these are.



By the letters in this figure, the colours are thus marked: *r*, red; *o*, orange; *y*, yellow; *gr*, green; *b*, blue; *v*, violet. Two colours, which are opposite one another, complete each other in white: Red and green, orange and blue, yellow and violet. Now our perception of colour recognizes each of such pairs of comple-

mental colours to be harmonious colours, which constitute a totality of light, and with it a harmony of colours. Goethe has treated this very successfully.

§ 64. Two colours, between which there is only one intermediate colour, constitute, according to Goethe, characteristic combinations of colour; for example, red and yellow, yellow and blue, blue and red. He mentions that these combina-

tions are on that account made use of in uniforms. But this does not appear to be the only reason; for orange and green, green and violet, violet and orange, are not easily so employed, although green is used in uniforms. But we may here remark, that this green is almost always dark, and approaches blue. Besides, it appears that the size and division of the surface must be also taken into consideration; for yellow for the coat, and red and blue for the lower garments, do not meet with approbation. Besides the size and division of the surface, the strength of light, and the gloss, must also be taken into consideration.

§ 65. The juxtaposition of neighbouring colours does not make an agreeable impression upon us, unless particular conditions are added. Goethe says that green with yellow has something ordinary in it, but in a cheerful sense; green with blue is ordinary in a repulsive sense. This can only be granted, and is also hardly understood in a more extensive meaning than in the case where colours are unmixed, and when they are about equally strong, and occupy equal space. Some examples will warn us against too exaggerated an application of this axiom, and at the same time show what a variety of conditions must also be here considered. The blue of the sky, seen through the green tops of the trees, always produces a joyful impression. It undoubtedly appears most beautiful when the leaves are turning rather yellow, so that the green colour of the leaf is not so close to the blue of the sky, which in some degree approaches to the violet; but even when the green of the leaves changes into blue-green, there is beauty in the impression. This undoubtedly proceeds from the preponderating force of light in the blue of the sky. The pleasure we have in light itself must have an important share in it, since, while we are under the branches of the tree, we are in a shade, which enlivens the light of the sky.

The little blue flower of the "Forget me not," attracts the eye in the midst of the green surrounding it. Here the smallness of the surface, the clear light of the colour, and its distribution upon a beautifully formed flower, appear to have a great share in the favourable impression; but so far is certain, that the juxtaposition of the blue with the green has no unfavourable influence here. Every one will easily, from his own experience, recall various examples both of blue

and yellow flowers, surrounded by green, which afford enjoyment to the eye. I will now make an observation which I have not yet had an opportunity to submit to proper reflection, but which is, however, founded upon the joint impression of my daily experiences; namely, that green when placed next to the most richly coloured flowers, and, if I am not mistaken, especially next to yellow and blue, is very far removed from pure green, so that it may be said to contain very little actual green. Besides, the flower often has a great deal of gloss upon it, and it not unfrequently happens that the power of light and colour is weakened in the stalk and leaves by their being clothed with a hairy covering.

I venture to add one more observation, which Natural Science has hardly yet enabled us circumstantially to prove, but which appears to me to possess a great inward probability; namely, that the opposition which always arises by the separation of matter, might also be expressed in the opposition of colours. Consequently, in the instance here mentioned, the separation of those materials, by which certain combinations are formed which belong to the petals, and of others which are retained in the stalk and in the leaves, produce the opposition. It may certainly be alleged against this supposition, that the chemical separations which are here intended, do not only consist in a separation of the matter within the limits of the plant, but also in the abstraction of certain materials in the surrounding air; but even with respect to this, there appears to be an opposition between the green and the coloured surfaces.

The application of the theory of beauty to the vegetable kingdom, and especially to flowers, will certainly give rise to a new development and more accurate determinations of many parts of the universal theory of beauty. The juxtaposition of the different figures of leaves, of petals and the parts of fructification, the various differences which arise from the variety of colours, and from the marks of colour in many flowers, in the petals and parts of fructification; the various conditions of the surfaces, of which a shining surface has already been mentioned, but among which many must still be cited, for example, those with a velvet surface; the relative distance in which flowers and leaves are placed with what surrounds them. But all this must be taken into consideration along with much which has not been yet thought of.

§ 66. The opposition of light and darkness is apparent in many ways in the juxtaposition of colours. Flowers with strong light colours, for example, yellow, are especially adapted for stuffs with a dark ground; upon a light ground, on the contrary, feebly light colours are the best, for example, blue. Red flowers are as well adapted for a dark ground as for a light, because this colour has a middle degree of the power of light, and also prevails on account of the size of its vibrations.

§ 67. The great influence of a shining surface in the relations of beauty has certainly been often mentioned in the preceding passages, but with only a few applications. Brightness forms an important part in the impressions which we receive from all nature. The blue of the sky would not produce the same impression upon us, if its brightness were wanting. The brightness of water, contrasted with the feeble light of the surface of the earth, contributes to enliven the landscape in an extraordinary manner, as is well known, so that the waters have been called the eyes of landscapes, to which notion we are justly led by our lively impression of the brightness of the eye. Every one must have observed the delightful impression of beauty which we receive from the reflection of objects in a quiet surface of water. Besides other things which contribute to make this image so attractive, its brightness has a great influence. The smooth surface of water, which reflects a great portion of the light of the sky, covers the painting which is exhibited to us with its brightness in a more vivid manner than the most beautiful varnish could do. The various alternations in the brightness of the water (which is at the same time influenced by colour) also deserve notice. It is well known that on a day in which the sky is blue, the water is so also, since it reflects the light of the sky. But if we turn our eyes upon those parts of the expanse of water which are very distant from us, and from which we consequently receive the reflected light at very acute angles, we shall find that the brightness is much stronger here, for the smaller the angle of incidence, the larger are the number of incident rays reflected. By this means the brightness increases in intensity till it resembles metal, and since but little of the blue of the sky is mixed up with it, it has a really silvery brightness. This effect is produced to a still greater degree by the direct light of the sun by day, or the direct light of

the moon at night. Painters seldom fail in their representations of this condition of nature, which they learn by acute observation; but a poet might perceive the same thing, were he to sit beside a brook, and look down into the silver waves.

It need hardly be repeated that the brightness of the evening and the morning red, of the rainbow, and many such phenomena of the air, constitute a part of their beauty. In all cases, where the brightness is stronger than the eye can conveniently bear, it is well-known that it will become dazzling, and by its incongruity with the rest of the power of apprehension, disturbing to the impression of beauty.

§ 68. We have here considered the effect of light and colour in the various relations in which they externally appear to us. Since these effects also occur in our own organs of sense, it appears that, in order to understand them, it would be best to turn our attention upon ourselves. Neither must this be delayed; though the changes which take place in our own organs of sense possess only a small share of the distinctness which is requisite to arrive at some insight. On the contrary, we must treat our own eye as if it were something external to us; for example, from the dissection of the human eye we must learn to know its wonderful structure, and by our investigations into the general laws of the motion of light, the laws of refraction, and its capability to form pictures, we must inquire into the laws of the external world by which sight is made intelligible to us. This has been confirmed by an extensive scientific experience, and we ought not to be misled by the circumstance that one remarkable mind, Goethe, was of opinion that the usual path of science in the treatment of the doctrine of light, conducts on a false track. But now that we have observed the effects of light, where they best reveal their nature to us, we may again return to ourselves with the profit we have obtained from the external world. Both considerations must be regarded separately, because we cannot employ them together, but we must never forget that they both belong to one whole, in which the external and the internal are no longer separated.

§ 69. Anything which influences the nerve of the eye, even a pressure, a blow, a direct mechanical touch, produces a sensation of light, and with it a sensation of colour, but no other sensation; whereas we cannot produce a sensation of

light, by influencing any nerve which is not connected with the nerve of sight. Therefore, the æther-waves act upon our nerves of sight, similar to other mechanical forces, but they are the only ones able to awaken a sensation of light, which is capable of communicating to us a knowledge of the external world. The eye is not, however, here subject to different conditions than the other organs of the senses; for, in perfect accordance with it, the forces which act upon the nerves of hearing, produce only sensations of tones, those acting on the nerves of smell, only sensations of smell, and so on.

§ 70. This reference to the mechanical view of the action of light, ought not, however, to induce us to overlook much more that it contains, and which is requisite for a perception of the impression of the senses in its totality. This impression consists naturally of two principal active forces, the æther-waves and the capacity of our senses, and is the united effect of both. But many others lie concealed in these two principal activities.

A thick veil is thrown over the action of the nerves of the senses; but we know rather more of the action of the waves of light; and this knowledge is such that it permits us to guess something about the action of the nerve of sight. We know from experiments, that light produces a change on every surface upon which it creates pictures; so that a disposition, or tendency, to re-create the same picture, after the light has ceased to act, is still retained for a certain time, and can be made perceptible by a certain condensation of steam. In the nerve of sight a similar creation of a picture takes place, of whose duration we are instructed by the sense itself. If we do not limit our idea of chemical action merely to apparent combinations or separations of materials, but if we ascribe to it all inward changes of condition, we thence learn, that in the creation of the picture, a chemical action must be produced on the nerve of sight. But even if we did not allow it this name, we cannot deny that such a change in the condition of the surface is very important, and is accompanied in the surfaces of inanimate bodies by concealed electric and magnetic circulations. We can scarcely divest ourselves of the idea, that something similar takes place in the nerve of sight itself. In short, in

the sensation of sight, the combined forces of the world express themselves, however hidden and secret they may be.

In all that we learn from science about the sensation of feeling, we shall only henceforth bring forward that which is most nearly connected with the comprehension of the Beautiful.

§ 71. In the same manner as each effect requires time to be produced and time to vanish, so it is also with the sensations of sight. However quickly these may come and vanish, nevertheless we have decided experiences concerning them. Every impression is succeeded by an endeavour after an opposite sensation: after a sensation of light, a sensation of darkness; after a sensation of red there follows the complementary colour (§ 60), green, and inversely after the sensation of green there follows red, and so on. These changes are usually too feeble to be remarked, but we perceive them when we try stronger impressions, and exclude other effects of light which might alter the relations. In experiments with strong white light, several developments of colour occur, which must be omitted here.

§ 72. We can more easily convince ourselves of similar effects by experiments on illuminated white and coloured objects. If we look at a strongly illuminated white figure upon a dark ground, and then turn our eye upon a white surface, we see upon it the image of the same figure, but darker than the rest of the surface. If the experiment is made with a dark figure upon a light ground, the image upon the white surface appears lighter than it. This last case does not essentially differ from the first, for the ground creates the image just as much in the eye as the figure, and they only assume different places in the two experiments. If the same experiment is made with coloured figures, we see likewise, when we turn our eye upon the white ground, the same figure but with complementary colours. Thus the counterfeit of a red figure is green, of a green figure red, &c.

§ 73. If we look for a long time at a coloured picture upon a white ground, we shall see it cover itself with the complementary colours. It has not been yet ascertained whether the reason of this is, that there is really produced on the retina of the eye a sensation of complementary colours, externally round the picture of the object, or whether the eye, which is

never perfectly still, causes some part of the retina of the eye, which formerly received the picture, now to receive the impression from the ground.

The condition here treated of is not without its practical importance. If we desire to imitate a pattern or a painting by embroidery or weaving, and if we select the coloured threads without regard to the influence which their juxtaposition exercises upon the impression, we shall see, when the work is completed, that we have been deceived. We must, therefore, with reference to this, make previous experiments.

§ 74. But from all this we perceive that the nature of the eye itself conveys with it the development of harmonious colours. This could not also be otherwise, for if it contains the whole capacity of developing light, each development of light and colour requires its opposite. But the method of proceeding in natural science does not allow us to build upon such proofs, but to represent truth in a series of perceptions, of which, besides, only some few have been here brought forward as examples.

It will now be instructive to reconsider the relations which are represented in § 63—§ 65.

When two complementary colours are placed beside one another, they will strengthen each other; the red, for example, placed next to the green, will become a deeper red, and the green at the same time a stronger green. It thus happens that the harmony of colours is realized to our feelings, which is already determined by this, that the complementary colours constitute a totality of colour.

In the juxtaposition of colours, which we have called the characteristic combinations, the reciprocal effect produces some additional force and alteration. In order to make this apparent, we will exhibit the characteristic colours in pairs, and that colour shall be placed under each which calls forth the feeling of the other.

Yellow — Blue		Red — Yellow		Red — Blue
Orange — Violet		Violet — Green		Orange — Green.

If, on the contrary, we place together the neighbouring colours, a completely different relation is produced; for example:—

Yellow — Green		Green — Blue
Red — Violet		Orange — Red.

We see, in the last case, that to one colour in each pair an entirely new colour is added, whereas in the first case it is a colour which contains something of its own.

It also here appears how the idea that the complementary colours must form a harmony, because they constitute a totality of colours, is realized to the feelings, not through an accidental combination, but from the necessary harmony which is the consequence of common fundamental laws.

§ 75. It is sufficiently known by daily experience how much colours serve to embellish the surface of things. So far as this embellishment only consists in an arbitrary application of colours, the effect of it must depend merely upon the general laws of the relations of colours. In natural productions, whether they are minerals, plants, or animals, the colours are undoubtedly determined by laws, according to which they are dependent partly on the peculiar nature of the object, partly on its relation to the external world. These laws will undoubtedly long remain an object of investigation for future times. Our knowledge concerning them is still too scattered and disconnected to make any use of it in the natural philosophy of the Beautiful, whereas there are cases where form and colour may be perfectly comprehended by us as the production of the same natural action; from these observations we may already learn something.

§ 76. The Rainbow belongs to such forms. It is not part of the design of this representation, to repeat here the well known theory of the rainbow; it may justly be assumed as known. We learn from this theory, that the form of an arch is the necessary consequence of those laws by which the light is refracted and reflected in the drops of rain. But by the same natural action by which this arch is formed, the rays of colour which the white light contains are separated, and a harmony of colours is developed, in which all the colours of sunlight appear before us, both in their separation, which is accompanied by the division in space, as well as in their totality, which they have retained from their source. But the whole contents of the perception are here by no means exhausted. The contrast between the dark wall of rain and the clear arch, immediately awakens the peculiar pleasure we derive from light, heightened by the conquering splendour which the light here unfolds in its struggle with darkness, the benevolent powers against the destroying powers. It is a

natural idea apparent to the mind, in which the palpably evident and substantial is excluded. In the northern legends of the gods, it is imagined to be a bridge between heaven and earth.

§ 77. Among the remarkable combinations of form and colour, also belong many of those which are produced by the reciprocal effect of the rays of light upon one another, which we may call their reciprocal encroachment, and which, by the English expression formed from the Latin root, has been designated Interference. This effect is only recognizable where rays meet which proceed from a luminous body of very small extent, for otherwise the effect which certain rays produce is destroyed by rays which proceed from other points. The effect produced by reciprocal encroachment proceeds from this, that those waves of light which meet in such a manner that their similar vibrations fall in the same portion of space, strengthen one another; whereas when opposite vibrations meet together their reciprocal effect is destroyed. Since the different rays of colour have unequal breadth of waves, so also the strengthening and darkening of the light will not happen to all in the same point of space. This is not the place to develop the whole of this doctrine; it must suffice to recount, as the result of science, that we are able to calculate exactly upon every failure in experiments. Some examples will explain this union between form and colour.

§ 78. If we allow the light which comes from a very small luminous body, for example, through a burning glass, or rather from the image of the sun which is produced by a still smaller collector of the rays, to pass through small openings lying close together in any thin metal plate, the cone of rays which have thence arisen will meet upon their continued path, and in some parts of the space strengthen their reciprocal action of light, in others destroy it. Hence there arises a multitude of bright and dark spots, which are certainly not connected, but they have a regularly arranged inward position, often a great variety of symmetrically-divided forms, and, besides, splendid and symmetrically-divided colours.

In order to make a short survey of what has been just said, it will be best first to turn our attention away from the colours. We may in reality make the experiment so that no

development of colours takes place. To do this it is only necessary to choose light of a simple colour; for example, light which has passed through red glass.

One of the simplest instances is attained, by which there arises a great variety of forms, if we allow this simple light to pass through three very small holes in a thin metal plate, placed before the opening of a particularly good telescope, which, however, in order to observe the effect, need not be of very great magnifying power. We should then see an image in whose centre there is a powerfully red circle surrounded by six others much less bright, which have certain regular deviations from the circular form. Beyond these there are at different distances other spots, still more deviating from the circular form, with a different strength of light, which are also regulated according to the laws of symmetry. The ground is black. An architect who saw the colourless drawing of this image, said that if it were made upon a convex surface, we should pronounce it a decoration conceived with great originality.

§ 79. If the experiment is now undertaken with colourless light, every kind of coloured light which is contained therein would by means of its unequal breadth of wave change the position of each of the spots formed by it; the violet would fall nearest the centre, the blue somewhat farther from it, and so on, green, yellow, orange, red. Still the difference is not so great that they entirely separate from one another; on the contrary, they will principally fall upon one another, and thus form the most beautiful distribution of colours; so that we either see in every spot the colours of the rainbow in perfect separation, with the violet side everywhere nearest the centre, and thus the red next the circumference, or the mixture of colours which is formed by the one encountering the other.

If we allow the light to pass through a plate with four openings which stand at the same distance from one another as the points of the angles in a square, we likewise receive an image compounded of symmetrical spots, but of which two systems which are more distinct than the others cut each other, and form a cross. The splendour of the colours in this cross is great; in the intervening parts, on the contrary, the intensity of the light is smaller, but it is symmetrically distributed.

If there are many small square holes in the plate placed very near each other, there arise several systems of bands which form a whole combination. Exactly before the holes, we see a series of small square spots of light, the centre one white, the others with symmetrical colours. Next to this series we see a system of bands, which run narrower towards the centre of the series, and in which the violet light appears in the narrow part, which is nearest the centre, upon which follow the other colours according to the breadth of their waves. After this system of bands there follows a darker interval, and upon it another, less broad, formed of longer, but fewer, and therefore broad bands. Upon this there follows again, after dark intervals, a new system of far fewer and broader stripes than those just preceding. The system which follows upon this, according to the same law, is separated by no dark interval, but falls with its narrower end into the broader one of the preceding system, and thus two more still follow, of which the one before the last is the longest of all.

In similar ways we can produce many combinations, in which that which is conformable to law is immediately felt by the senses, and not merely, indeed, by the distribution of forms, but also by that of colours. In most cases the colours which thus appear are splendid and piercing, but at the same time they are excellently suited to those transitions which are satisfactory to the eye. I believe that those who would desire to paint in the style of Pompeii, would do well to study the conditions of colour treated about here, and not merely to make the thoughts but the eye familiar with them.

§ 80. We may derive the same advantage from the colours which are developed by polarized light, when this is exposed under certain conditions to double-refracting crystals, or bodies in which a peculiar extension preponderates. To give a somewhat complete representation of this remarkable theory would lead us too far from our real aim, but a short sketch of the nature of polarization will enable us to give a comprehensive representation of that upon which it depends. The æther-waves by which light is produced, are so constituted that the vibrations happen at right angles to the rays. Let us, for example, direct our thoughts upon a cone of rays

which proceeds from a point in the sky, and passes down perpendicularly to the earth, the vibrations in its æther-waves would all be parallel to the horizon, but in this plane, they may have all possible directions. Now if a crystal, which is capable of polarizing light, but in the most simple form, be placed across these rays (for example, Icelandic calcareous spar), the vibrations will be all so arranged that one half passes in one direction, the other half in that which is at right angles with it; so that if the crystal were so placed that some vibrations happened alternately from north to south, and from south to north, the others would take place alternately from east to west, and from west to east. The two kinds of polarized rays are at once separated from one another by an unequal refraction. It will now be intelligible, when it is said that the rays have received a definite polarization, when they are brought into such a condition that all their vibrations happen in one plane. We must not here confuse the ideas which we have formed of polarization with those which we know of magnetic effects. The use which has been made of this word in the theory of light, is really entirely at variance with polarization, and is not a happy word, though it has now been authorized by long application. Light is also polarized by reflection under certain angles, and equally so through refraction. The rays which are completely polarized by refraction have their planes of vibration at right angles with the plane of vibration of those which are polarized by reflection.

When the vibrations of polarized rays are parallel with the surface of a transparent body, and stand at right angles to their plane of incidence, we can always find a certain angle of incidence, under which all the rays are reflected, and none pass through. If the plane of their vibration is, on the contrary, the same with the plane of incidence, and the direction of the vibrations therefore crosses the reflecting surface, they will all pass through under the same angle of incidence, and therefore none will be reflected.

There are other more involved conditions of polarization besides those which we have just treated of, that have here been omitted, which may, however, be all referred to the fundamental relations that have been explained.*

* Those who are acquainted with the doctrine of the polarization

§ 81. By reflections and refractions the planes of vibration of polarized rays, with the exception of certain cases which are determined by the nature of the thing, suffer bendings and separations, and may arrive again at recombinations. If we consider the example given at § 80, we may say that rays in which the vibrations formerly passed from north to south, and from south to north, may afterwards be placed in such a condition that, for example, some vibrations occur from north-east to south-west, and from south-west to north-east; while some take place in the plane at right angles with it, between north-west and south-east. The separation of the directions of the vibrations always happens in such a manner that the two new planes of vibrations stand at right angles with one another.

A number of cases occur in different reflections and currents where rays which have proceeded from one point, and have accordingly received a common polarization, suffer such changes in their continued path, that when they are afterwards brought into the same plane of vibrations they still vibrate in opposite directions, when they pass through similar paths; and, on the other hand, vibrate in the same direction, when their paths have a difference in length of 1, 3, 5, or several unequal multiples of a half breadth of wave. From this relative condition it follows that the rays which ought to have strengthened one another, if they had not suffered these changes in their planes of bendings, now mutually destroy their effects, and that, inversely, those which otherwise would have reciprocally destroyed their effects, now strengthen them. It would be impossible to develope

of light will perceive, that, in order to make the representation more intelligible, I have turned the whole attention upon the planes of vibration, and I have avoided speaking of the planes of polarization, which are at right angles to them.

The sunlight which is reflected to us by the sky when it is clear, is also polarized, and certainly in different ways. The light which is reflected from that part of the sky which is exactly opposite the sun, vibrates parallel with the horizon; that light, on the contrary, which comes from situations which lie 90° on both sides of it, vibrates at right angles with it. Hence it follows, that the portion of the sky which is about 90° from the sun reflects itself imperfectly, and illuminates the water less than the remaining part, particularly if the angle under which we behold the illuminated water is between 30 and 40 degrees.

this circumstantially here, without bringing forward a very extensive portion of the doctrine of light; to which whoever wishes to penetrate this subject must be referred: but we must keep ourselves to the result, that rays which have proceeded from one point and suffer no perceptible separation, may receive opposite qualities merely by the turn of the plane of their vibrations, which is exhibited in this, that those colours which are developed in these changes out of the white light, receive, by the reciprocal encroachment of the rays (§ 77), this remarkable inequality, that the colour which exhibits one kind of these rays is the complementary colour of that which exhibits the other; if, for example, the one produces red, the other will produce green.

§ 82. From all the relations mentioned here (§ 80, § 81), which will require some trouble to be familiarly acquainted with, but which, once understood, are sufficiently comprehensible, the various forms of light and colour are explained, which are produced by certain crystals and other transparent bodies within which certain extensions of direction prevail. By particular reflections and currents, in consequence of the laws of polarization, certain rays, which have a symmetrical position relative to each other, are stopped; whereas, in all other points, colours are developed which constitute the complement with one another, and are therefore harmonious among themselves. The symmetrical forms which are thus developed are for the most part unimportant, but the colours are often splendid, and have always a harmony founded in the nature of the thing.

§ 83. In consequence of the similarity which we find between the production of light and of sound, it is supposed by some that a *Colour-music* may yet be discovered. But the similarity has been considered here in a more one-sided point of view than it ought to be. The relation of time which is so prominent in tones, is very much hidden in the actions of light, in which, on the other hand, the relations of space are so important. Besides, the eye is strongly excited by lively changes of light and colour which quickly succeed one another. Dull colours, like those which are reflected from coloured surfaces, will, on the other hand, exercise an unimportant effect. If it were desirable to produce anything which should resemble a *Light-music* it would be necessary

to select darkness for the performance. Light-music by daylight would be like Tone-music amidst a great noise. The only Light-music which we know are fireworks, which possess a certain kind of beauty, and might perhaps be brought to a still greater degree of beauty; but we ought not to expect that an art can be developed from it which can be compared to music.

ON THE UNBEAUTIFUL IN NATURE,

IN ITS RELATION TO THE

HARMONY OF BEAUTY IN THE WHOLE.

THE following communication is extracted from the reports of the Society of Sciences at Copenhagen, and originated from some observations on the above-mentioned subject, which the author had delivered to the members of that Society. He there began with saying, that although he had often reflected on this subject, he yet felt how far he was from having solved all its difficulties; but he was chiefly impelled to communicate his own views by a wish to hear the remarks of his fellow-members, and after that, those of other men who were learned on the subject. The communication occasioned discussions, which have not failed to influence the representation as it is here exhibited; for some objections showed the author that on certain points he had not sufficiently developed his views; and by some remarks in support of his opinions, he was, on the other side, enabled to express himself, at least on one point, with greater confidence. He also thinks he must first apologise, because, in order to maintain the observations which had a direct reference to the subjects under consideration, he has enlarged upon some things which are not in immediate connection with them.

IN the dialogue on Tones the fundamental doctrine is upheld and afterwards carried out in various directions, that we receive impressions of beauty from that which is reasonable in things, yet not in such a manner that we comprehend it by thought as reasonable, but because our inner sense, in conformity with its own reason, feels a satisfaction in the reasonable.

It might at first sight appear that it must follow from this doctrine, that everything in conformity with reason is beautiful; but the answer to this is, that our inner sense is only able to grasp the impression of the most simple thought. The limit to this is not fixed, but, on the contrary, may very easily be altered. All are aware that the sense of the beautiful, as well as the external senses, has a different degree of

acuteness in different people, and that it may also be rendered more acute in each individual by practice in the power of observation, and by the imitation of beautiful objects; but that the influence of the mind is able to develop this inner sense, is a truth of which perhaps we cannot so well say that it has been doubted, as that it has been too little employed to enable us understand the theory of beauty. A few examples will place this in the clearest light. It is well known by experience, that men whose business requires them to make frequent measurements, and to meditate on them, thereby acquire a facility in the instantaneous determination of magnitudes and their relations, without the necessity of previous reflection. That which previously had been gained by reflection has now become direct knowledge. Those whose minds have been much engaged in the use of figures thereby attain similar readiness in the direct discovery of numerous relations of figures, which can only be grasped by others after long reflection. Although the examples I have selected, from their being so well known, refer to many things which do not belong to the comprehension of beauty, they are yet not entirely foreign to it; for the proportions of measurement are one of the elements of the beautiful.

In innumerable cases we form an image of things in our inner sense, of which we have never received a direct impression from the senses. Long before it had been discovered how to represent countries upon maps, men who had made travels of observation invented for themselves a picture of the country over which they had travelled, and communicated it to others. This picture did not then originate in such men from mere perceptions of the senses; the distances, for instance, were frequently determined by different circumstances; for example, from the time spent on certain journeys compared with the difficulties which had been surmounted. The extent and height of mountains, the course of rivers, the size and form of the coasts, could have been as little gained, exclusively, from direct perception of the senses, or even from the description of others, but must have been obtained by inquiries in various directions. This picture, however, created by the active forces of both sense and mind, now stood forth in the intuitive perception of man, and he was enabled by speech to awaken the same picture in others. The delineations of countries which are made in our times, are the result

of innumerable measurements and calculations; so that the picture of a country that we obtain by the assistance of a map proceeds from a union of the perception of the senses, and activity of thought. If it is still asserted that he who now contemplates a map, only receives the image by the aid of a direct perception, it must still be granted that he who first drew a map was not similarly circumstanced. Besides, it is very evident that he who merely receives the direct impression by the senses of the map of a country, and whose contemplation of the map is not accompanied by much knowledge acquired by thought, and who does not besides inquire any farther about the matter, will obtain but a very poor picture of it in his mind.

The knowledge of things which we have gained by thought, is thus incorporated into our inner perception as a mental image; and when the opportunity occurs, it is renewed by the direct nature of the perception, consequently without the renewal of all the thought of which it is the fruit. The faculties of the mind and the senses have laboured at this knowledge in common, and it remains therefore perpetually common property, only each of these faculties employs it according to its own method. This may be said even with respect to objects of a less material nature. He who is acquainted with a variety of languages, and has inquired into their mutual relations, will not only judge with consideration and reflection and more correctly on the objects relating to them than he who is ignorant, but he will also judge of them in consequence of a direct impression. Even complete results of thought will thus be brought within the range of perception. For instance, we at first comprehend, in a direct manner, the figure of the circle; and our inner sense, in consequence of its original conformity to reason, will be satisfied with this impression; but he who has reflected on the various properties and relations which we are instructed by thought to discover in the circle, will, in addition to this, have an idea of the oneness of the thought in which they all belong to one another; and if we have made ourselves thoroughly acquainted with it, this idea is impressed as a remembrance on our inner sense, and produces an ideal image, which not merely belongs to reason but also to our senses, which receive it as something directly floating before it.

While our inner sense is thus penetrated and fertilized by

our other faculties, and acts, both in our power of comprehension as well as production with a direct effect, it is not merely a sense in the narrower signification of the term, but receives the name of imagination. The beautiful then is comprehended, and, so far as it originates from ourselves, is created by this faculty of sense. It acts according to the laws of reason, similar to all the forces in the world. This indeed very frequently happens in a manner which escapes our inquiry, but, nevertheless, we have fortunately seen so many distinct traces of it, that we have been thence enabled to make conclusions on the whole, as we do with respect to the laws of nature.

From all that has preceded, we perceive that the imagination has a series of stages of development, which are interwoven in a variety of ways. Some important stages of development might be pointed out here, as particular periods are established in history; but this should not be attempted in the present case, whereas three main divisions may be distinguished in the co-operating faculty of the comprehension of beauty:—the real natural sense of the beautiful; the imagination, as a natural sense, which has been cultivated by the various activity of the different faculties of our souls; sight, through knowledge, which exists where knowledge has become so clear that the truth acquired appears to the inner sense in a perceptible form.

So far as the inner sense apprehends things in a direct manner, its principal objects will be figures which express simple thoughts; symmetry, even of very involved forms, shadows, and relations of colours; the motion of sound (rhythm), and the more simple relations and movements of tones.

Much which this sense would comprehend as beautiful, if it could receive the impression of it at once, or within narrow limits of time and space, is exhibited to it in such a manner that the widely-separated parts are represented to it singly. This will be explained by an example which points to many others. If we imagine a tree stripped of its leaves, entirely alone, we shall rarely think it beautiful, and yet in a wintry landscape it may form a portion of a beautiful whole. Let us now go further, and imagine the tree in its entire annual course of being, and then the poverty of its wintry existence will be adopted into a whole image of life, and form

a part in its beauty. It is true that such examples only show that what is not individually beautiful *can* form a portion of the beauty of the whole; but more than this is not here intended, for the sense, merely acting in a direct manner, cannot comprehend the more involved natural thought. Every one will remember a sufficient number of examples, when single natural objects, which in themselves alone made no impression of the beautiful, still have not failed to produce it when joined to the effect of surrounding objects and of illumination, with the half-shadows proceeding from it; setting aside the consideration that man is not often in a condition to comprehend things with the united animation and repose which is necessary to feel accurately what is offered him by nature. Therefore, that which is not comprehended as beautiful by the senses, is frequently only a fragment of a beautiful whole; we may compare it with a fragment torn from a symmetrical whole, or with a dissonance which can be so resolved that, in connection with several tones, it becomes incorporated with a somewhat greater whole in tones.

We must refer to something similar, when we consider the comprehension of beauty which takes place when an object which, out of its natural position, seems to be opposed to beauty, yet exhibits itself as beautiful when it is seen in its proper natural position. We consider the swan beautiful, but that would hardly be the case, if we had not become accustomed to view it through the oneness of all the impressions in which we habitually see it. The celebrated orator, Burke, whose thoughts on the beautiful have gained a degree of reputation which is certainly undeserved, employed, among other things, the universally acknowledged beauty of the swan to support his opinion, that beauty does not in the least depend upon figure, that it does not *alone* depend on it was not sufficient for him. We will not dwell any longer on his views of the question, but we will employ the swan as an example, to explain the meaning of the natural position of an object, with respect to the apprehension of beauty. Let us imagine a man so situated, that he had never seen a water-bird; let him see a swan for the first time in a poultry-yard among the other fowls, and deprived of access to any large piece of water, in which he could clean his feathers and preserve their dazzling whiteness: would he then think him beautiful? He would perhaps

admire the graceful curve which the neck assumes in certain positions, and the red beak; but he would be struck with its imperfect equilibrium, and would say there was a wonderful disproportion between the long neck and the short tail, with the short legs and broad feet, which cause such a waddling gait; but let him now see it swimming on the water in its proper and natural position, and he will hardly recognise it. In general, it is only when seen on a quiet piece of water, in which it is reflected, that we observe the swan with sufficient accuracy; and, joined to the reflection, it offers a most beautiful symmetrical figure. Its feathers, constantly kept clean by the water, exhibit themselves here in their dazzling whiteness, and form a beautiful combination with the broad red bill, and the dark eye which appears between the red and white; besides this, all want of equilibrium has now disappeared. The water supports the tail: it is only an exception when it is supported by the legs. The neck, which even in its curved posture is very beautiful in itself, contributes to the equilibrium of this position, while the swan glides slowly and majestically over the surface of the water. The imagination adds still more to this almost direct impression of beauty. A notion of purity is awakened within us by the whiteness; and since whiteness and purity are symbols of spiritual qualities, we receive this impression imperceptibly, although we by no means attribute these perfections to the animal itself, but it becomes a symbol to us of something higher than what we directly behold in the object.

From another side imagination adds to these new ideas; while we behold the half-raised wings of the swan, we immediately think of its similitude to a distant ship, and of its power to fly. The impression we receive from the whole phenomenon contains something of the sublime and the powerful, of the pure and the harmonious, which is often increased by surrounding objects,—for instance, by the blue sky which is reflected in the water, by the brilliancy of the water itself, and by a background of green trees. It is only with some few that the legend of antiquity about the song of the swan, and that this bird was dedicated to Apollo, will add still more to the impression. But if we now behold the swan on dry land, do we cease to find him beautiful? The whole image which our imagination has drawn for itself, generally follows us to the firm ground, to which the creature

is a stranger, and it is but little altered during the short time in which we usually see it there; but should we behold it there for a long time, its structure, which is so ill adapted for such a condition, would make a great change in the impression which we had received when we saw it in its true natural position. We are so accustomed to see the swan in its proper place, that we are almost puzzled to view it in any other light. The case is totally reversed with regard to the ape. If we set aside for a moment the sensations which are aroused in us when we compare it with man, and if we transfer ourselves to those countries where it appears to us in its natural position, in the woods, on the branches of the trees, amidst their foliage, where we are amused by its alertness in climbing and its merry leaps, it both serves to enliven surrounding nature as well as to awaken a pleasure in connection with it. Its resemblance to man, which, however, has been too highly estimated, has been the occasion of comparisons which have mortified our self-love, but have had still more influence in exciting a feeling of disgust towards the creature. This may be sufficient to indicate something which may contribute to the solution of this natural dissonance; perhaps one endowed with greater knowledge may be able to do this still better, or perhaps its solution will even require a degree of knowledge which does not yet exist. To obviate misunderstanding it must be expressly said here, it is by no means necessary that, within a certain range of our comprehension, we should cease to consider the ape as ugly, since the ugliness we discover in it may be resolved into a comprehensive harmony similar to a natural dissonance: each of these comprehensions has its justification; only one of them in a far higher and more extensive circle of existence than the other.

The bat may serve to explain another sort of ugliness in natural objects. It belongs to the mammalia, and yet it has a false similarity with birds, as its fore feet, with their disproportionately lengthened toes, are joined together with skin, and serve for instruments of flight, though they but little resemble the wings of birds. This creature deviates so strongly from the form of the mammalia, that by the apprehension of our senses we cannot place it among them; and the same occurs when we attempt to assign it a place among the birds. The bat terrifies our imagination as something unnatu-

ral, although it has undeniably its appointed place in the series of development of animal life; but this is not apparent to the imagination. It was only when a most profound knowledge was able to point out, in simple and distinct terms, how it belonged to the Whole in nature, that the imagination was able to make a corresponding image. In the present state of our knowledge the imagination must remain irreconcilable; nay, in addition to this, because this creature passes its life in the dark, it therefore still more reminds us of something at enmity with the beautiful and the good. Reason cannot require that the imagination should comprehend the case otherwise, but it previously informs us, that it is precisely because it hides itself in the dark that its entrance into our world of beauty is hindered; and reason does not doubt that the bat is a species of animal which forms a part in the connection of the whole of creation. We easily perceive that the difficulty is not here represented as solved, but only that the necessity existing in the world of reason indicates that it may be resolved; and that by means of distinctness, produced by reason, it must one day be reconciled with the imagination. The apprehension of ordinary life is not thence destroyed, for this reconciliation occurs only in proportion as Imagination passes into Knowledge.

It is only from this point of view that we can regard monsters, in their connection with the harmony of law in the whole of nature. As far as our knowledge has yet reached, we see that they are produced by an excessive enlargement or diminution of certain organs, and our observations on this kind of disproportion generally disclose important secrets in nature; but by what laws they are arranged into the rational harmony of the whole, will probably be the result of a future discovery.

Even the poetic spirit has its influence on our comprehension of beauty; we do not here allude to occasional poetic strains, but to the poetry of human society. Thus the position which we assign the lion, in our world of beauty, is not alone bestowed on him on account of his form. All that has been said about his strength in those countries which he inhabits, has accompanied our knowledge of the form of the creature, so that our imagination receives a much stronger impression of the lion's otherwise really powerful external appearance. The knowledge which we derive from our ex-

perience of man himself, that the strong can raise themselves more easily than others above trivial emotions, has permitted man to attribute a kind of magnanimity to the lion which he does not possess; but if I may venture to say so, it is the natural poetry of the human race which has caused us to fix upon the lion as endowed with this quality; and on that account the imaginative faculty of the human race, or perhaps only of certain large human societies, has been justified in accepting this view.

In the same way, the imagination has formed notions of those creatures which most immediately surround us, or which come into most frequent communication with man; and such joint productions of the perceptions of our senses and of our imagination hold good within the circle of existence for which they are formed.

In the same manner certain animals have been assigned a place among things that are ugly, although it has not been the result of a simple impression of the senses. The serpent may serve as an example of this. Our experience of the poisonous character of many certainly shares in this influence. By the natural poetry of the human race, our dislike of them is increased. This comprehension of the serpent as an ugly animal, has the same validity as the impressions we have already mentioned of some other creatures.

Let me be excused for making one more observation, namely, on fictitious forms. The artist has often employed wings, to denote the power possessed by gods or angels to move through space over the earth. So far as these wings are employed to designate this power, they perfectly answer the demand of the imagination; but as far as the author remembers, artists, though not in ancient times, have frequently represented the wings of such an immense size, and placed in such a position that the imagination must accept them as the actual instruments of flight of the creature represented. Where this occurs the creature loses its character of the supernatural; it desires to be natural, and becomes unnatural. It is a law in nature, that wings, in all the vertebrate animals, are only formed by a peculiar development of the instruments of motion belonging to the fore part of the body, such as arms in men and forefeet in all the mammalia; consequently birds have neither arms nor forefeet. The imagination which has become familiar with this law in nature, must thus come into collision with this

fictitious alteration in the form of man. Many who have only casually heard of the law, but who have never traced its signification in nature, will doubtless not object to the addition of wings. Their thoughts upon this subject, which are floating in mere vacuity, do not compel them to see its impossibility; but he who has some knowledge of the muscles which would be required to set in action such new instruments of motion, and all the extensive organic changes which these would again presuppose, perceives that the alteration, if it were complete, must convert the flying figure represented into a totally different creature from man. The author offers this dubious question, produced by a study of natural science, to the consideration of artists, and those competent to judge of this subject.

There is yet one more important kind of ugliness for us to consider, namely, those things which are connected with the destruction of the living being. Few things make such a strong impression on us as corruption. To the direct perception of our senses it is disgusting; it is dangerous to life, and horrible to the imagination. From a finite point of view, it can never fail to make this impression on us; for it does not then exhibit the high signification of material destruction in the whole of natural life, and still less the hope which there exists for man beyond this destruction. But in the highest mental perception, the connection which exists between them, and which is learnt by knowledge, also appears before the imagination, and creates a sublime picture of beauty, perceiving which, it never occurs to us to descend to the remembrances of material impressions. Individual external signs of death may be employed by the artist, especially the painter; for instance, a death's head and bones, placed beside a man engaged in devotion, by its connection with a higher hope, it then becomes a resolved dissonance. The poet whose representation is not fettered to the direct impression of the scenes, can go still farther, and may elevate us to a height where the descent is only the entrance to a higher life.

There certainly is a spiritual sphere of apprehension, with respect to all which is apprehended as unbeautiful or that is ugly in nature, where it forms a part in the beauty of the whole. Were it now possible to comprehend all the objects, beautiful or unbeautiful, on the surface of the earth, in an

image small enough to be surveyed, where all objects must naturally be contained in their proper mutual proportions of magnitude, then, probably even, this sensational perception would form one whole of extreme beauty.

The author is deeply persuaded how little these remarks are calculated to master the great task which he has at present touched upon; but it seemed to him beneficial, that he who made such a great task the object of his inquiry should venture to offer his thoughts for examination, although he himself may be far from the end in view.

If he has comprehended the case correctly, then Ugliness, as likewise, *in a certain sense*, Evil, becomes a finite condition; on the other hand, that which is essentially Beautiful is Eternal.

CHRISTIANITY AND ASTRONOMY.

FROM THE DANISH POPULAR JOURNAL, 1837.

THE object of this Dialogue would be misunderstood, if it were thought that it was intended to prove the Copernican system. A book of considerable size would be requisite for such a purpose, which would, to a certain degree, necessarily contain a popular view of all Astronomy. Desirable as this might be in other respects, it would not supply the place of the present Dialogue, for this is not written for those who rely on the proofs of Astronomers, and still less for those who possess practical knowledge of this branch of science, or a knowledge of Mathematics and Natural Philosophy; but it is written for those who believe that there are grounds, even for those who are ignorant of science, for rejecting the theory of Astronomers. It is said, for instance, that the so-called Copernican system, which assumes that it is not the sun which moves round the earth, but the earth which moves round the sun, is opposed to the manifest testimony of the senses, and that we must believe that Tycho Brahe, who denied this system, deserves more confidence than all those who accepted it; that the old views we find in the Bible have been expressly confirmed by experience; that even if there could be two opinions on the correct comprehension of passages in the Bible which are viewed as important in this matter, it must be maintained that the Copernican system is opposed to Christianity. This dialogue has not been called forth by intimations of these opinions in print, but far more by the experiences which I have gathered in daily conversation with reference to the notions which religious excitement has created on this subject.* I honour the pious feelings which are exhibited in this case, but I am firmly persuaded that repugnance to these views can only proceed from misunderstanding. This I have done all in my power to remove; and I only wish that my earnest endeavour to write within the comprehension of a large proportion of my readers may be in some degree successful.

I shall perhaps be told that the astronomical opponents whom I now permit to step upon the scene are too prejudiced and ignorant, and not sufficiently clear-sighted. Since I do not contest the point with any single person, but only wish to operate against preconceived opinions which I have found scattered among a great number of people, I have been compelled to set to work in the manner I have selected: had

* The Copernican system was violently attacked, about that time, by the hyper-orthodox party, and condemned on scriptural grounds.

I not been desirous to distribute the prejudices among a greater number of persons, which would have easily occasioned me to be more diffuse, it would not have been more advantageous to my cause. Perhaps it may be objected, on the other hand, that there are many queries and answers in this dialogue, which show that I am not afraid of being diffuse, and I may not indeed have hit the just proportion in this respect; but where certain links in the chain, which in themselves are unmeaning, serve to draw attention for a sufficient time in the course of the dialogue to one point, I hope they will not be considered as superfluous.

ALFRED. PALMER. NORTHLIGHT. ERWIN.

PALMER. I think we have now completed our business; and as Erwin wishes us to remain with him this evening, I should like to mention something, on which I have long wished to know the opinion of experienced people. Northlight often tells me that all recent astronomers are but children compared with our old Tycho Brahe; and that he has not the slightest doubt that the opinion of our old astronomer on the solar system is more valuable than that of all the others. But now that Alfred, who understands astronomy, is here, I am very desirous to hear his opinion on the matter.

NORTHLIGHT. You might hear that another time. I know it already.

ALFRED. You astonish me. I never remember to have spoken to you on the subject.

N. You are right in that; but I know that all astronomers of the present day are of one opinion.

A. I ought not to call myself an astronomer, although I have made myself in some degree acquainted with astronomy.

N. Is not that sufficient? If you have applied yourself to astronomy, you are certainly a pupil of Copernicus.

A. Yes, I do indeed believe that the earth moves round the sun.

N. Did I not know that beforehand?

ERWIN. But if all those who have studied astronomy are so united in opinion, we must thence conclude that there is no foundation for a dispute.

N. Do you not believe so? There is a sort of compact among them.

P. But it would be a very remarkable compact that so

many hundred men, of so many different parties, both in religion as well as politics—men who were in some points at variance with one another upon important scientific subjects—should always continue to be of opinion that the truth concerning the arrangement of the solar system ought to be kept secret. I should sooner believe that all those who now speak against the Copernican system were in the secret service of the Pope, because he condemns it; although the importance of the thing has extorted from him the permission that it may be proposed as the most convenient basis of calculation. Meanwhile, I am far from really admitting this convenient mode of explanation. Yet it is quite incredible to me that, among the various people who have pursued astronomy during the last two centuries, there should not at least have been one who was not either sufficiently honest, or sufficiently ambitious, or sufficiently desirous for the great reward which he might have expected from the Court of Rome, to have betrayed the secret.

N. There certainly have been such men; but if any one rises and says that the Copernican system is false, astronomers are immediately at hand, and unanimously declare that he understands nothing of their science.

P. But they might teach it to other honourable men.

N. The incredulous world would beware of visiting such a teacher.

P. But those who are credulous? There is no small portion of these.

N. They can spend their time on something better. Do not let us speak any more about it. Do not require that I should believe a new-fashioned bookworm rather than our old Tycho Brahe, who drew his learning from the great star-book of the heavens.

A. It certainly entirely depends upon yourself whether you wish to discuss astronomy; but as some of your words were aimed against me, I must be permitted to show that they did not hit me.

N. Well, let us hear.

A. You spoke as if I had never read in the star-book of the heavens, but I must say that I have several times observed the heavens, and have seen things there which Tycho Brahe never saw.

N. That was probably the Copernican theory.

A. You certainly do not mean precisely what you say, for you cannot indeed believe that I never observed the heavens with a telescope.

N. But Tycho Brahe did not possess that wisdom.

A. He died in 1601, and the telescope was discovered at a later period. The first time that it was used in observations in the heavens was in the year 1609, and the first publication of what was discovered by this new expedient appeared in the year 1610.

N. Who knows whether Tycho Brahe had not himself discovered and employed it previously, without mentioning it!

A. And would he at the same time have remained silent on what he saw by means of it? Your zeal for our celebrated countryman leads you too far.

N. Well, what new things were discovered by the telescope which Tycho Brahe had not already seen?

A. Galileo, who first employed the telescope for observations, discovered that the planet Jupiter had four moons.

N. Well, that was a good thing for him.

A. But still better for us.

N. How so?

A. We have by it obtained a glorious means of determining how far one place on the earth lies east or west of another.

N. I cannot certainly contradict you on this point; it lies beyond me.

A. By no means. I will not at present speak according to the Copernican system. I begin by saying that the sun rises in the east. You have nothing to say against that?

N. No; that is spoken rationally.

A. Any spot which lies due east of another spot has consequently its morning, mid-day, and evening, at an earlier period of time than this last; and even if it does not lie exactly east of the other, but at the same time rather more north, or rather more south, which would produce a difference in the length of the day, together with the rising and setting of the sun, still the spot situated most to the eastward would have an earlier mid-day.

N. That is of course understood.

A. If one spot lies so far to the eastward of another that its distance from it forms $\frac{1}{24}$ of the whole circumference of the earth, it is already 12 o'clock in the former, when it is 11 in the latter place. If the difference were two hours, then the

distance between the two spots would be twice $\frac{1}{24}$; in other words, $\frac{1}{12}$ of the circumference of the earth. If, on the other hand, the difference were only half-an-hour, then the distance would be only half a twenty-fourth; that is to say, $\frac{1}{48}$ of the circumference of the earth. If the difference were four minutes, which constitutes $\frac{1}{15}$ of an hour, we must then divide the circumference of the earth into 15 times 24—that is, into 360 parts—to obtain an extent as long as the distance between the two spots.

N: All that put together is perfectly good; but now what farther?

A. Now if we had a sign that it were possible for us to see at the same time from different places, even many hundred miles apart, and that the moment in which the sign was seen the stroke of the clock of that place were to point to a clock, which followed with exactitude the course of the heavens, should we not from it learn the difference of time in those places, and might we not use this to calculate their reciprocal eastern or western position?

N. Good!

A. Well, we have a similar sign every time one of Jupiter's moons conceals itself behind that planet.

N. But that proves nothing for the Copernican system.

A. I did not even intend it should do so; but my object was to speak further with you on your doubts; and I wished to seize this opportunity, to give you an example that it has not been merely trifles which have been discovered since the spirit of Tycho Brahe ascended into that world where he no longer required our telescope.

N. I have nothing to say against this, if I can only see that these important things would not have caused him to alter his opinion.

A. It is true that this important result of the discovery of Jupiter's moons would not have changed his opinion; but it contained something besides, which might have had a great influence on it. Consider for a moment that the chief ground why the Copernican system is not gladly adopted by the multitude, is because they dislike to abandon the notion that all the heavenly bodies were created for the earth alone; and on that account, that this was the centre round which the whole universe turns. Must we not doubt this idea, if we have seen that other planets have also moons; and, indeed,

moons so far removed from us that we cannot behold them with the naked eye. It requires a strong power of imagination to believe, that such moons were rather created for us, than for the spheres which they illuminated.

N. But yet you said that these moons were of great use to us.

A. You are very ingenious. But you forget that the planets Saturn and Uranus also have moons, which are still more difficult for us to observe, and on that account are not easily employed for determinations of this kind. Yet you might yourself conceive that in the future we may reach such a point, as to derive some benefit from them here on earth. But if on that account you would say that they are merely created for the earth, you would not, probably, find many who would believe that you were serious.

N. Do you not then believe that Tycho Brahe, if he had become acquainted with this discovery, would have been unable to answer it?

A. I am willing to believe that; for what can we not defend, if we desire no more than to defend ourselves against the fancied humiliation of confessing error? But I think far too highly of Tycho Brahe to attribute such a sentiment to him. He was an inquirer after truth, and not a contemptible advocate. Dissimulation did not belong to such a man. I must, meanwhile, observe that I have pre-supposed in my answer that he had seen this fact in connection with the others, partly by the aid of the telescope, partly by mathematical researches on discoveries which had already been made; for it is rare that any one fact standing alone will determine the opinion of a well-grounded thinker. Even in the two years immediately following the first use of the telescope for observations in the heavens, there occurred various discoveries which must have had the greatest influence on the notions concerning the system of the world. Before the telescope was known, people could still cling to the idea that the planets were distinguished from the earth by their lustre. It was said, the planets are luminous bodies; that the earth is dark: how then can we say that the earth goes round the sun like the other planets? It has no similarity to a planet. The telescope removed this objection, and plainly showed, what previously could only be surmised, that those portions of a planet which are not illuminated by the sun, are

obscure, similar to the unilluminated portions of the moon. The earth may therefore seem to the other planets to have the same lustre as these or the moon appear to us to possess.

N. But would Tycho Brahe have also allowed himself to imagine that the planets must be as great, or still greater, than the earth?

A. It was not necessary to teach him that. He well knew that the heavenly bodies are so far distant that they must be very large to be seen as we see them, and that many of them must be far larger than the earth. We have, indeed, now more exact measurements than his instruments permitted, although, for their time, they were excellent; but this alters nothing in the main question. What, on the other hand, he was unable to see with his own eyes, was, that the planets have spots on them like the moon, and that, by observations on their changing position, we can perceive that the planets turn on their axes.

N. On this point I once read something from which I learnt that the astronomers, who were formerly so united in opinion in all things, are now disagreed whether the planet Venus accomplishes her rotation in somewhat more than twenty-three hours, or whether she occupies more than twenty-four days for it. What now is to be thought of the other revolutions?

A. Astronomers are forced to submit to a very severe treatment. If they agree in their opinions, their enemies do not hold it to be from conviction, but by a compact. If they disagree on the exact period of the rotation of a single planet, this must prove that they disagree with respect to all those planets on whose period of rotation they are unanimous.

N. Very well. We will allow the astronomers to agree that planets do turn upon their axes.

A. Tycho Brahe did not see the mountains in the moon.

N. Nor have I seen them, and yet I once viewed the moon through a telescope; but I saw nothing more than that it was uneven.

A. You are right; but unevenness which is so great that we are able to perceive it at a distance of 50,000 miles, must be rather more than a few yards high. And great elevations on a sphere, you will probably call mountains?

N. But is the moon so far distant?

A. That is proved by measurements. Even your friend,

Tycho Brahe, contributed to this calculation, and even if his measurement could not be quite so exact as that of the present time, there would not be such a great difference as to oblige us to notice it here? But we have now an opportunity in which you may allow yourself to be instructed by experiences and observations, which are quite within the sphere of contemplation of the sound understanding of man.

N. Let us hear. I am curious.

A. Do we not see the highest objects on earth at the greatest distance?

N. Of course.

A. And inversely, if we can see the summit of an object at a remote distance, we must conclude that this summit lies high above the flat country, or the surface of the ocean.

N. Certainly.

A. A mountain must be very high, even when it is seen at a distance of twenty miles; now when the moon can be seen at one and the same time from several places, which are more than 1,500 miles apart, it must be many hundred miles high above the earth. This is, indeed, indeterminately and feebly expressed, when compared to our exact knowledge; but it is sufficient to prove, that no learning is required to conceive that the moon is much farther removed, and that it must be of a much greater size, than the thoughtless multitude, who doubt the calculations of astronomy, can have any idea of. They might come to the same conclusion; nay, they might themselves gain a better idea of its distance, if they consider that, whether we behold it high or low in the sky, if it is not so low as to oblige us to see a number of terrestrial objects at the same time which impede our view, it appears to us equally great, although it floats over places which are many hundred miles removed from one another.

N. I must, indeed, grant that my doubts on this point went too far.

A. If your faith were not opposed to it, would you not now yield, dear Northlight?

N. I dare not appeal to faith, in opposition to astronomers, but I may, indeed, appeal to my senses. If these show me that the heavens turn round, and that the earth stands still, no subtilty shall make me believe that it is the heavens which stand still and the earth which moves.

A. You are not far removed from maintaining, that for the honour of our senses we ought to deny the understanding.

N. How so?

A. We should be forced to believe, if we were compelled to follow your principle, that a thing which we see at a great distance is really small, and that it gradually becomes greater, the nearer we approach it; that an avenue, where it is most distant from us, is narrower than where it is near us; that the lamps in the street are so much closer together the farther we are removed from them.

N. Well, our senses themselves rectify these errors.

A. Therefore the testimony of the senses requires correction.

N. Yes, by comparison with one another.

A. But you do not then mean to say that the senses themselves make the comparison; for the faculty of comparing things which we have seen at different periods must be ascribed, indeed, to the understanding.

N. Allow the understanding to have its share; but the senses are the chief agents.

A. I do not think so. But I would rather ask you a few more questions to learn your real opinion. When a ship makes a turn, does it not seem as if the shore ran round the ship!

N. It does, indeed.

A. And in the evening, when I wander in moonlight, and it seems exactly as if the moon accompanied me, then the senses again correct themselves.

N. The senses here require no correction, but only the astronomers; that does not concern me at all.

A. I think, however, it does; for instance, when two travellers meet one another, and each of them asserts, on the testimony of his senses, that the moon has accompanied him, which of them is in the right?

N. I am still of the same opinion, that here the one experience corrects the other, and that we thence learn that the moon has accompanied neither of them.

A. But now if an inhabitant of the planet Jupiter were to meet with one of the inhabitants of the earth, and if the first said, according to the evidence of his senses, that all the heavenly bodies turned round his planet, but the last that

these revolved round the earth, the one experience might then likewise correct the other.

N. But I doubt whether Jupiter has any inhabitant; and, supposing it has, they will yet never meet us.

A. Therefore the same thing happens to us, the inhabitants of earth, as would happen to the traveller in moonlight, if he met no one.

N. No, he might correct his error if he turned back.

A. By no means, for his senses would then only have taught him that the moon turned round with him.

N. But even though the senses do deceive us now and then, still when God's Word does not speak to us, we have nothing further in which we can confide.

A. The understanding?

N. There is no dependence on that.

A. You are its great enemy. Yet you allow it to precalculate the whole almanac, with the length of the days, the rising and the setting of the sun and moon, &c. You even allow it to foretell the eclipses of the sun and moon during the whole year. You also permit it to invent machines which furnish you with many of the comforts of life, which otherwise would either be unattainable or unknown, and even to arrange the civic commonwealth by well-considered laws. In short, the understanding is a misapprehended friend, to whom you must apologize.

N. But does the understanding never err?

A. How, indeed, could I venture to deny the truth, that man may err in the use of each of his mental faculties, just as much as in that of his senses?

N. Then there is no other wisdom than the Word of God. I will hold fast to that.

A. That is perfectly true. Such is also the opinion of astronomers.

N. How am I to understand that?

A. As naturally as possible. The movements of the world they read in the book of laws which God has written in the heavens with his own hand.

N. But they read it by the aid of their own deceitful understanding.

A. Let us, however, speak somewhat more exactly. Astronomers first became acquainted with the heavens by

the aid of their senses. They have collected the experience of thousands of years on the events of the heavens. They have continually endeavoured to invent better instruments, in order to see the planets, and to measure their magnitude, distance, and movements. They have always compared their calculations with what occurred in the heavens. Ought we to doubt that so much honourable diligence and so much inquiry does not, in some way, lead to truth?

N. Yes, if our understanding were not so obscured.

A. Do not, however, imagine it so obscured as to lose the power of calculating events of the heavens hundreds, nay, thousands of years beforehand.

N. Tycho Brahe was also able to do this, although he permitted himself to be guided by the Bible.

A. If the Bible were a guide for astronomical calculations, then Tycho Brahe would have learnt from it the laws of Kepler.

N. I have heard so, but they chiefly relate to theory.

A. They are founded on experience, and we owe their first consolidation to Tycho Brahe's beautiful observations. Meantime, the experience of two centuries has confirmed them. Every new planet which is discovered has given a new proof for these laws. When Sir William Herschel, in 1781, discovered the planet Uranus by the aid of Kepler's laws, only four years afterwards we were enabled to calculate that it would require eighty-four years for it to go once round the sun. When, in 1801, Piazzi discovered the planet Ceres, but after a few days of observation fell sick, and was then unable to re-find it, its proper position in the extensive space of heaven was rediscovered by calculation, which rested on the same laws. Once more, in later times, we have received a great proof of the validity of astronomical calculation by Halley's comet. For seventy years and more it had been invisible to the inhabitants of earth, but its path was calculated, and it came at the predicted time.

N. But does it not occur to you that you attempt to prove astronomy by the coincidence of prophecies?

A. This quibble of words is not new to me.

N. You call this remark a quibble of words?

A. Yes, a quibble of words. What more? When you say that it is not right to prove the truth of scientific opinions

by prophecies, you certainly understand by prophecy a prediction which has sprung from an inner feeling or perception, without the understanding being able to account for it, and prophecies, in this sense, do not belong to science; but if you will understand by prophecy a prediction founded on knowledge clearly manifested to the understanding, then it entirely belongs to science. Besides, I beg you will ask your understanding whether it is not a great proof of correct knowledge, when we are taught to predict events in a determined manner, not merely indefinitely, but with the utmost exactitude of time and place; and when such predictions have been confirmed many thousand times, is not the proof then beyond the means of refutation. And is there any use in bringing forward other proofs before people who have not themselves studied science, and who will not give the requisite time to study it?

N. But was it not then possible to pre-calculate the events of the heavens just as correctly, according to Tycho Brahe's doctrine?

A. Before I answer this question, I must call your attention to the fact that there are two kinds of pre-calculations in astronomy. The one is founded on this, that we must have collected some tolerably complete observations on a whole series of changes, and have seen them recur constantly in the same order. We then predict that it will occur at a future time. This kind of prediction clearly requires no insight into the laws of nature. The other kind, on the contrary, is especially founded on and distinguished by this, that by the universal laws of nature, we can foretell something about objects which are new to us. We do not, then, proclaim the return of that which we have already seen take place with the same things; but something which natural reason, through the force of knowledge, says must necessarily happen. The two first examples which I have just given belonged wholly to this class, and neither the system of Tycho Brahe nor the older system anywhere offers a similar one. Even that example which I drew from Halley's comet, in which part of the prediction rests on a frequently repeated recurrence, still contains this peculiarity—that we should have been unable to predict the inequalities in the periods of circulation, had we not been in possession of Newton's glorious theory, which

is most intimately connected with that of Copernicus, and without which also most other astronomical calculations would be imperfect.

N. In what does this Newtonian system consist?

A. To give a somewhat circumstantial account of the chief elements of his doctrine would be too much for one evening; but its most simple principles I will gladly mention, for they speak to the unprejudiced and sound understanding of man. He has developed the great thought, that the movements of the planets occur according to the same laws as the movements here on earth.

N. Which laws do you allude to?

A. I must first mention one which was discovered before the time of Newton, namely, that an inanimate body can as little set itself in repose if it is in a state of motion, as it can set itself in motion if it is in a state of repose.

N. That seems rational enough, but it is contrary to experience, which shows us that a body set in motion—for instance, a ball which we roll down a path—often stands still of its own accord.

A. No; only because the little inequalities which it encounters, and the particles of air which it must drive out of the way, gradually cause it to stand still. It has been proved by innumerable experiments that a movement lasts so much longer the more these kind of obstacles are displaced. But we may draw still more results from this absence of will in the inanimate object; for on this ground the body set in motion neither can alter its velocity nor its direction.

N. But yet we see that a ball or a stone which is thrown in a direct line describes a crooked path.

A. The cause lies extraneous to the body that is thrown; it is gravity, which is a power by which the earth attracts all bodies to itself.

E. The law which you now explain is called the law of inertia.

A. Certainly it is called so, but this name easily leads to the belief that an impotency is attributed to bodies which would little accord with nature. Bodies are not wanting in forces to act, but in a will, even to begin a change in the application of their forces.

E. It is really astonishing that mankind remained for so

many thousand years unacquainted with such a natural thought. It was, indeed, Descartes who first discovered it.

A. We must rather say, gave it general admission; for Galileo had already grasped it. But at all events, the full signification of the absence of will in matter was not perceived above a century and a half before our times.

E. Exactly; but I fear that I have interrupted you too much. I must not prevent you from continuing.

A. It is the result of gravity that all material things attract each other throughout the whole world. The movement of falling bodies is occasioned by their being attracted from all parts of the earth.

N. That seems to be explained naturally enough.

A. Now Newton farther says, that the attraction between two bodies becomes so much the more feeble the farther they are apart; not, indeed, that they attract each other twice as little when they are twice as far apart, three times as little when the distance is three times as great, and so on: but he shows that both the force of attraction, as all other active forces, which proceed equally in all directions, acts so much the more feebly at the greater distance; and that to find the degree of feebleness, we must multiply the proportion of distance into itself; so that the force in twice the amount of distance is twice two, or four times less; in three times the amount of distance three times three, or nine times less; and so on.

N. That is quite extraordinary.

A. On the contrary, it is natural. Let us take our example from another active force, that we may be enabled to follow it better with our senses. Place a bit of paper one yard from a light, this paper will receive a certain number of the active forces of light, which the flame emits on all sides. Now move it two yards distant, and it will not receive nearly so much activity of light; much that was previously received now passes it. If we were to put another piece of paper in its place, which at the distance of two yards should now receive all the action of light which was before received at the distance of one yard, it must be twice as long and twice as broad as the first; but this gives four times as great a surface. You thus see that this mode of dispersion lies in the peculiar quality of space.

N. I did not believe that it was such a natural thing.

A. Newton now shows farther, by an ingenious calculation, that the magnitude of the effect which arises from the attraction of all portions of a sphere, is so constituted, as if all these portions were in the centre; which cannot, in reality, be the case, but which greatly facilitates certain calculations.

N. For what does he use these calculations?

A. When we wish to compare other attractions with those on the surface of the earth, we have simple means for the purpose. The distance of the surface from the centre we may call a radius of the earth. Now, if an object is at the distance of two radii of the earth from the centre, then the earth attracts it four times as feebly; if it is distant ten radii of the earth, one hundred times as feebly; if it is sixty radii of the earth removed, it is sixty times sixty, or 3600 times as feebly attracted.

N. You have to make a long calculation.

A. It is now completed. The last calculation tells us how much the moon is attracted by the earth when it is removed about halfway between its greatest and least distance.

N. But how can we see that the calculation is correct?

A. You remember that the straight path is the movement which bodies must follow when nothing diverts them from it. Now the moon never continues in the direct path towards which its course aimed at the preceding moment, but the attraction of the earth constantly causes it to deviate, so that the moon necessarily wanders round the earth.

N. That does not, however, seem so certain to me.

A. The one thought, nevertheless, has led us to the other; meanwhile, we are not yet at the end. If we calculate the curve which is exhibited to us in the moon's path by observation, it is just as great as it must be, in conformity with the doctrine of attraction. Every minute it deviates from the previous direction fifteen feet five-eighths. Figure to yourself distinctly what this really expresses, that amidst all the innumerable magnitudes which this deviation might possess, we, in reality, hit on the only one which is the result of the doctrine of attraction. You must add to this, that the moon, in each of its rotations, one time approaches nearer by one radius of the earth, another time recedes as much farther.

away from us. In each new position it has a different distance, and makes a different curve; but in each of them we also obtain a different number from fifteen feet five-eighths, and always exactly that one which follows from the laws of attraction. You thus see that all these various numbers prove an agreement between thought and reality. Do not you think that this must inspire confidence?

N. I confess it is very remarkable.

A. Now if we further calculate the paths of all the planets round the sun, we find again that they are exactly constituted as they must be if the sun attracts them according to the laws we have considered. The same occurs when we consider the moons of other planets. Their paths are exactly such as they necessarily must be if the attractive force of the planet acts according to the same laws as those of the earth and the sun.

N. This, then, is the universal doctrine of attraction?

A. Only a very hasty sketch of it. To behold it in its inward harmony, we must devote much diligence and time on it, which, nevertheless, we should never repent. But I observe that there still remains much whose omission would be inexcusable, even in this rapid sketch. I must, especially, beg you to observe, that Newton's theory proves that the figure of the earth entirely depends on the same universal laws of nature, as the laws of motion belonging to it and to the other planets. A careful research has shown us that the earth has been fluid before it assumed its present condition. These fluid particles, if not otherwise prevented, necessarily arrange themselves into a sphere, where all parts of the surface are equally distant from the centre. But the rotation of the earth on its axis, altered this. Its rotation does not set in motion the portions of the axis; but every other portion must describe a circle, which is so much the greater, the farther it is from the axis. Now, both inquiry and experience have proved that there is an endeavour in such a circulation to remove to a distance from the centre of the circle, and that this endeavour increases with the magnitude of the circle described. Hence it happens, that the rotation of the earth expands the earth in its great central circle, which we name the equator, and in all the parts lying near it. This perceptible deviation of the earth from the spherical form, was disco-

vered by inquiry sixty years before the experiences were collected which confirmed it. The peculiar form of the earth is, therefore, a proof that it turns upon its axis.

N. I scarcely know what to say further.

A. And the planets also exhibit a deviation from the spherical form, each according to its magnitude and velocity of rotation.

N. I do not deny that there is a great unity in this doctrine; but this unity is but idle talk to me, for I am compelled to say, that it is opposed to the Bible.

A. You allude to the well-known passage in Joshua, where it is said that the sun stood still; but it appears to me, this as little proves that it was the author's opinion that the sun really moved, as if we were to assert, that he who writes the almanac adopts this opinion, because he says that the sun rises or sets, instead of saying that the earth turns itself on this or on that day in such a manner; that in Copenhagen, it appears as if the sun rose about seven o'clock. We should be more inclined to ridicule the astronomer, if, for the honour of his system, he were to express himself in such a pedantic manner. It is certain that if Copernicus himself had related the aforesaid events, he could not, without pedantry, have expressed himself differently from Joshua.

N. But yet the Bible must be understood literally.

A. Even in this acceptance there must still be one passage which you cannot take literally, namely: *The letter killeth, but the spirit maketh alive*. But I need not enter here on a discursive treatment of the subject. There are a sufficient number of passages, when the Bible speaks of the earth, in a manner which cannot possibly be taken literally. Is not the globe mentioned in several passages in perfect accordance with our notions? But in other passages (for instance, Job xxviii. 24), the ends of the earth are mentioned; and in the Revelations, the four angels who hold the four corners of the world. In Job xxviii. 13, and in many passages of the same book, the wings of the earth are cited as the most poetical designations for the movement of the earth. But if we desire absolutely to believe that the Bible teaches us astronomy, it seems, when all is put together, that it rather teaches the movement, than the absence of movement in the earth. I think, meanwhile, that the Bible, if it had been intended

to teach astronomy, would have certainly expressed itself more distinctly.

N. It will indeed be difficult, perhaps even impossible, to reply to this question by single passages from the Bible; but all my Christian feelings are opposed to the doctrine of astronomers.

A. If I understand rightly, you do not assume that the Bible contains the clear expression of the doctrine that the earth stands still, so that every one who builds upon the Bible must necessarily be convinced; but you think that a profounder comprehension of the view of the Bible in its oneness would determine the matter. You feel so persuaded that it is you, and those wedded to your opinions, who here understand the Bible correctly, and that you are guided by the Holy Spirit, that you venture to defy the strongest counter-proofs deduced from reason and experience.

N. You press me very hard. Shall I then abandon my Christianity, which I do understand, for your astronomy, which I do not?

A. Smooth words often deceive our senses. Express yourself with rather more exactitude, and your question assumes a very different aspect. Do not say, shall I abandon my Christianity? but say, shall I correct the method by which I, in accordance with many others, have understood Christianity for many years past?

N. Do not forget that this mode of understanding Christianity is of very ancient date.

A. Neither do you forget, that even amidst the ancient modes of comprehension there are great differences, and, above all, do not forget that there have been many men whose honest devotion to Christianity cannot be doubted, and who have found no real opposition between their religion and their science. Thus, there is one mode of comprehending Christianity by which it does not come into opposition with truths which reason and experience show us cannot be refuted; there is another mode of comprehension, by which Christianity cannot be united with these truths. I do not now ask, what you can answer before man; but I ask, can you answer before your conscience for imagining that the Holy Spirit urges you to reject decided truths? You say that you understand Christianity; but neither you nor any

man understands it fully. You say that you do not understand astronomy. That is true. But the question here is of certain positions on which all who have any knowledge are agreed, and which you would reject merely on the ground of your supposed deeper insight into Christianity, although many pious and learned Christians have adopted it.

N. I perceive that the case has assumed such an aspect, that I must appear arrogant to all those who do not agree with me, and yet I can assert that my opinion in this matter is connected with my whole inward being. I will speak openly. All your natural science is adverse to the disposition of my mind; it transforms the whole mode of thought, and turns it away from God. In your science, it is not He who permits the sun to rise and set, or who holds the earth in his hand, or who gives summer and winter. No; with you it is the blind laws of nature which accomplish this. It is not His anger which emits the lightning. No! With you it is only an electric spark, driven by blind necessity. It is not His power which permits the storm to sweep over the earth. No! it is disturbed equilibrium. It is not His goodness which sprinkles the earth with the waters of the heavens. No! it is only, as I have been told, a sport between warm and cool currents of air.

A. I call that well spoken; for you seem to me to have distinctly expressed the fundamental idea which determines your conviction. I will endeavour to be equally clear. But first tell me, do naturalists deny that the whole world originates from God?

N. No; they willingly grant this with reference to the whole; but yet they find the cause of each single event in the laws of nature, so that God has no part to act in it.

A. But from whom do the naturalists believe that these laws proceed?

N. I do not deny that they allow Him to be a lawgiver; but they do this in order that they may spare Him all further trouble with the government.

A. Do you believe that we consider these laws of nature to be regulations which some one has given to God?

N. You must indeed conceive that God has given them to himself.

A. But it could not then be impious to say, that God acted according to regulations which he had given to himself.

N. No; we certainly could not maintain that.

A. But do you think that the profound naturalist considers this mode of representation as perfectly worthy of the Divinity?

N. I do not know what you mean.

A. If we conceive the laws of nature to be regulations which God had once determined by himself to be those which nature should obey, and from which he has never deviated since, then the limits of our human capacities would be involved in the notion.

N. Then what is there true in it?

A. All existence is the unceasing work of God, in which there is an impression everywhere of his infinitely perfect reason, which never alters. This continuous operation of divine reason, and this eternal similarity with itself to the laws of nature, must be submitted to our consideration. It thus is literally true, when it is said that God permits the sun to rise, that he orders the change of the seasons, and the course of lightning; but many men are desirous that God should arrange these things according to their own notions, in opposition to nature, which notions are held to be so perfect in themselves, that they think the power and wisdom of God is denied, if that which they attribute to Him is doubted. That is the secret, you see.

N. Well, I willingly believe that a person may be a good Christian, although he admits the Copernican system; but I hope you will not deny, that he may be a good Christian although he rejects it.

P. Certainly, we can be good Christians with pure child-like faith, without either understanding or admitting any astronomical system whatever; but it would but little befit a Christian thoughtlessly to reject a scientific opinion which he did not understand.

N. Still we do not become better Christians by its adoption; we may view it with indifference.

A. I cannot even here grant you to be in the right. It is certainly true, that many men may be so ignorant that astronomy is necessarily a matter of great indifference to them, and that they must have learned much of other things, before they could derive true benefit from this. But all men are not so situated. Let us remember that every piece of knowledge serves Christianity. I was surprised when you required that

our contemplation of the physical universe should merely depend on the testimony of the senses. The common result of this is an entire misapprehension of human nature. Science has this in common with religion, that it endeavours to raise us above the impressions of our senses. Christianity, whose holy books are written in two languages, which are strange to most times and places, and which embrace so many subjects for inquiry, contains innumerable demands for reflection and cultivation. A great portion of the Christian world have obeyed these demands; and in spite of many errors which by the condition of humanity necessarily creep in, it has yet thereby reached a far higher degree of Christian enlightenment and Christian life than those barbarous nations who constantly mingle their gross conceptions with Christianity. Man, although religion strives to teach him something better, is far too strongly inclined to view the material world as actual true existence. Ought it not to contribute greatly to wrench him from this narrow circle of thought, if he sees that the earth which, to his imagination, was the firm support of everything, is itself only a moving part in a greater world; that heaven and earth are only an appearance, behind which lies a deeper and more enduring order in reason? Should not the insight that the whole world is not merely created for men, be a *small* remedy for his pride? Should not the magnitudes which a more accurate perception of the world places before the eyes of man, enlarge his mind?

N. How learned we must be, in order to become better Christians!

A. Do not misunderstand me. Do you think me so narrow-minded as to imagine, that every man ought to study all the sciences? No! It is not now a question of learning; we only here speak of the acceptance of discoveries with love and joy, which have been made in the system of the world by the investigations of many centuries. It is by no means indifferent whether man despises a noble spiritual enjoyment or not; the pleasure we receive from it is at all times an approach to God. Only survey, in your mind, the fundamental features of the system of the world. Every planet is a great dark sphere like the earth, and receives its alternation of day and night from the same sun. This is obtained by each of these spheres turning on its axis, so that one side is illuminated while the other is dark. In the same

manner each of them receives its seasons, because it goes round the sun in a certain time, and on a prescribed path; and each planet receives a lustre from the light of the sun, which contributes to adorn the night of the other. On this consideration we cannot avoid thinking, that these spheres are just as much inhabited as our own earth, although by beings who must be in some degree different from ourselves. What an incalculable variety here springs from one great fundamental thought! But what an infinitely wide circle is disclosed for our admiration, if we consider that each of these countless fixed stars is itself a sun, and a centre for the movement of other spheres. We feel ourselves at once elevated, by this glance, into the revelation of Divine wisdom and creative force, and penetrated by the deepest feeling of humility. If we did not know it before, we should be compelled to learn now, that we are nothing when compared *with* God, but that we are something *through* God.

ON THE SPIRIT AND STUDY OF UNIVERSAL NATURAL PHILOSOPHY.

I.

The Spirit, the Signification, and the End of Natural Science.

§ 1. We endeavour to comprehend and investigate the whole of nature by reason, and to represent it as a connected whole. The science which imposes on itself this task is called Natural Science, or Physics, in the most extensive sense of the word.

§ 2. If we cast an inquiring glance at nature, and think of comprehending this infinite variety by the aid of reason, we are astonished at the greatness of the undertaking. What an infinite multitude of objects we find scattered over the globe which we inhabit! What a countless host of animals are known to us by name! of insects alone probably a hundred thousand are described; and yet how many may be concealed from our view in the ocean! How many may inhabit countries which have never been trodden by the foot of an inquirer! What a countless number may escape our sight, concealed within the entrails of other animals, which can only be discovered by magnifying powers! No less wonderful are the multitude of plants, of which, indeed, a hundred thousand have been described. And further, the minerals of the earth, whose depths we have not penetrated as many fathoms as there are miles to its centre! What a vast scheme it must seem to become acquainted with all this! And yet it is but an infinitely small part of nature. If we raise our thoughts to our solar system, the earth appears only a point in comparison, but even this solar system is itself only a point when compared with that portion of the heavens which we can survey by means of astronomical calculation. But what is all this compared to the eternity in which imagination, as it advances in calcu-

lation, at length loses itself. If we now turn to the opposite side, and endeavour by analysis to penetrate into the interior of bodies, we continue to discover parts, which, upon a closer investigation, are found to be composed of others, which again are artificially constructed of different compound parts, and thus it continues without cessation. In short, we here also at length meet with something which our senses cannot comprehend. *On one side, we lose ourselves in the infinitely great, and on the other in the infinitely small.*

But still that is not sufficient. In the whole of nature we discover an action which knows no rest. What appears to our eyes as rest is only a slow change. Everything hastens through innumerable degrees of development, from its origin to its destruction. Its whole nature is not expressed in any single moment of its existence. In order to know it perfectly, we must therefore comprise all the periods which it has traversed, as in one focus. In other words, the infinite chain of existence which we call the world, which otherwise appeared beyond our comprehension, should not merely be viewed, as *it is*, but should be recognized as *it was*, and be calculated as *it will be*. We cannot say that natural science is exhausted until all this is attained.

§ 3. It is very clear that we have here only projected some of the principal features of an ideal. A science such as this will always remain incomplete to a finite being. Yet without an aim in view, we have no direction for our powers; and without an unattainable aim, the constant development for which the human race is destined cannot advance. The question therefore is: How can we possibly, within our narrow sphere, form a science for ourselves, which is an image, although a feeble one, of that ideal?

§ 4. A more deeply penetrating search into nature shows us an admirable unity in all this infinite variety. However much objects may differ from one another, still a deeper investigation discerns a common nature in them all. Thus we find the same law of organization in the whole animal kingdom, in spite of the greatest and most varied difference in their external form, and in their internal structure. While we have continually directed our attention, more and more, upon this fundamental unity, we have arrived at the conclusion that it is only necessary to know a few animals of each class, in order to obtain a true insight into the nature of the whole

time

base

unity
common
features

animal kingdom. By that means we can even obtain a tolerably correct idea of animals, which no longer exist, and whose remains are brought out of the deep recesses of the earth. We again meet with this same unity in the vegetable kingdom, where also a fundamental investigation of some few organizations is sufficient to give a deep insight into its nature. In a further investigation, we find one point of unity common to the animal and vegetable kingdom; yet even this is only part of a higher unity, until the mind is lost in one fundamental unity of the whole of nature which we encounter on whatever side we turn. The laws which influence our moon, equally influence the moons which accompany the other planets. The same laws govern the motion of these round the sun; and every planet that is discovered is only a fresh confirmation of this law. But we do not stop here; we have grounds to assume that our sun, along with several others, at the same time repeat on a large scale what is exhibited to us by our planetary system on a smaller one. Now if we once more return from those heavenly bodies to the bodies upon our earth, we find that they are all, without exception, subject to the same laws of motion and gravity as those heavenly bodies; so that from our experiments on motion made upon this earth, we may draw inferences ~~which may be referred to the whole universe.~~ If we are thoroughly acquainted with these laws of motion, we may calculate what was at one time the position of the heavenly bodies, and what it will be at any given time. Natural philosophy offers us various examples of this. We have discovered a similar harmony of laws in the successive periods of various other natural events, although they are far from being carried out with the same exactitude as in astronomy; for instance, regular periods in the development of the earth, and in the movement of the magnetic needle, although the duration of these periods has not yet been determined.

These examples show us clearly what is accurately proved by philosophy, *that every well-conducted investigation of a limited object, discovers to us a part of the eternal laws of the Infinite Whole.*

§ 5. Now these laws, and the powers by which they are made to act, constitute the only invariable thing in nature. While all other things incessantly change their position; while the

materials of which they are composed continually alter, the original powers and their laws remain stationary; they alone endure amidst this change. One thing is only distinguishable from another by the laws which are expressed in it; for we find the most dissimilar things composed of similar materials, and the further we proceed in our investigations, we shall be the more convinced that matter in everything, as well as the powers by which life and action are sustained in nature, are everywhere the same; but that which gives objects their determined character, and forms infinite variety, is only the manner in which the actions take place in everything, the natural laws by which all is arranged and guided. In short, things are incessantly passing from one condition to another; in one constant growth out of the same matter, by means of the same powers. But matter itself is only space occupied by the primitive forces of nature, therefore it is the laws according to which a thing is formed from which it derives its invariable peculiarity. But that which constitutes the invariable in a thing, and which distinguishes it, is correctly called its essence, and that part of its essence which it does not share with others, its peculiar essence. We may, therefore, affirm, that the natural laws according to which a thing is formed, taken together, constitute its peculiarity; and that the knowledge of the natural laws in action is the knowledge of the essence of the thing.

§ 6. But the essence of a thing does not consist in one single natural law, which may be expressed as an idea, in a proposition; but in a union of various natural laws, which form together a higher law, for which, however, we in vain seek an expression. We may, therefore, regard the essence of each thing as composed of innumerable others; but in itself it is only part of a still greater chain of being, and is connected by them with a higher unity (as, for example, the earth can never be perfectly comprehended if we do not at the same time consider it as a part of the solar system), which again is only a part of a still higher, and so on, till at length thought loses itself in the Infinite All. Thus all natural laws form together a unity, which, viewed in their activity, constitute the essence of the whole world.

§ 7. If we investigate these laws more closely, we find that they harmonize so perfectly with Reason that we may assert with truth that the harmony of the laws of nature consists in

their being adapted to the dictates of Reason, or rather, by the coincidence of the laws of Nature and the laws of Reason. The chain of natural laws, which in their activity constitute the essence of everything, may be viewed either as a natural thought, or more correctly as a natural idea; and since all natural laws together constitute but one unity, the whole world is the expression of an infinite all-comprehensive idea, which is one with an infinite Reason, living and acting in everything. In other words, the world is a revelation of the united power of Creation and Reason in the Godhead.

§ 8. We now first comprehend how we can recognize nature through Reason, for Reason again recognizes herself in all things. But, on the other side, we can also conceive how our knowledge will never be more than a faint image of the great whole; for our Reason, although originally related to the infinite, is limited by the finite, and can only imperfectly disengage itself from it. No mortal has been permitted entirely to penetrate and comprehend the whole. Filled with devout awe, he must be conscious of the limits of his powers, and acknowledge that the feeble ray which he is permitted to behold, nevertheless raises him far above the dust. Yet we are not connected with the inward essence of nature by the clear sight of Reason alone. As in our taste for the Beautiful we receive a sense for the impression of the spirit in forms, and in the conscience a sense for the impressions of Reason in life, so we also receive a sense for the impressions of Reason in the operations of nature, by which we feel its proximity, and without a distinct view of the individual parts, we are seized with an impression of the majesty of the whole. This anticipating consonance with Nature, guides reason in its inquiry, and is again awakened, strengthened, and purified by it; both are most intimately united, yet in such a manner, that the former is most dominant in life, the latter in science.

§ 9. It will now be quickly felt how wrong it would be to make utility the aim of this, or of any other science; for when we ask the use of an object, we infer that we attribute no substantial value to the thing itself, but only in respect to something else, which must, therefore, be superior to it. If science, therefore, is only to be pursued on account of its utility, there must be something more worth the attention of a rational being than the use of Reason, or something in man

which is superior to his mind; but since this is impossible, *science is good both in and for itself*, and it requires no extraneous inducement to strive after it for its own sake. It should be pursued on its own account, both as an expression of our inward life, and as an acknowledgment of that which is divine within us. That it also produces the most excellent results in a lower sphere, is a consequence of the harmony of reason which animates everything. It is exactly these results which are called the uses of science; and, so comprehended, we may call it the excellence of science seen from a lower point of view. On this depends the completeness of the observation, and thence it possesses an immediate interest to a thinking being. Seen in this point of view, the use of Natural Science is twofold, since it partly strengthens our powers even for the purposes of social life, and partly gives us means for their employment. Besides the general development and perfection which every science endeavours to effect on our mental powers, Natural Science especially contributes to enlighten and strengthen our finite reason, whilst it exhibits in a regulated series of contemplations the eternal laws of reason at the same time governing the external world. Impressed with this view, man enters upon each occupation with a more acute vision, with increased confidence, and with purer delight, and fulfils it as one who acts upon inward conviction, not following merely a precept from without. The soul is immediately brought into an inward peace and in unison with the whole of nature, and is delivered from every superstitious fear, which always originates in the idea that it is possible that powers which are contrary to the order of Reason might intrude into the eternal course of Nature.

This, in short, is the effect of an active love of science beaming forth in innumerable ways from within. In reference to the external sphere of action of the powers in nature, the excellence of science may be comprehended in the one great truth, *it teaches us to govern Nature.*

Nature offers the few necessities of life but sparingly to uncivilized man, and only affords nourishment to a small number in a large circumference. Science urges her to greater generosity, and causes the earth to become more fruitful, and its products to be improved and manufactured for purposes which could hardly have been anticipated in the original matter. Thus man provides himself with an easy and com-

portable condition in life, where previously necessity could hardly have found nourishment to allay its wants. Where men formerly laboured thoughtlessly, as mere tools, and passed their time in servile toil, science exempts them from this by means of machines, which work in place of them, and fulfil the purpose still more completely. Man by nature is limited to a narrow sphere: this is enlarged by his insight into nature. By the aid of science he sails round the earth, dives to the bottom of the sea, flies through the air, and thus is no longer fettered to the spot of earth where he was born. A deep investigation into nature has enabled us to enlarge even the boundaries of our senses, so that by artificial instruments we discover a world where to our unassisted senses there only appeared a vanishing magnitude; we discover mountains and valleys in distant planets, and systems of suns where formerly the most daring imagination did not venture to place their creations. Thus the whole existence of man is enlarged, and becomes more spiritual; so that it is evident that science and its results are mutually strengthened in their operations. Science assists in protecting whatever it presents to us. Without its aid man would be tossed to and fro by the wild struggles of the elements, which were appointed for more universal purposes in nature. By science he learns to control one natural power by another, and often to guide to a salutary end that which appears most threatening. Thus it teaches us to alter the course of heaven's destructive lightning, to stem the power of water so that it may serve our purposes, to sway the consuming operations of fire, and to force from it the most important services. Even if the universal forces in nature are in direct opposition to the inner forces by which our body subsists, science teaches us to find a remedy, an antidote against poison, a cure or even a protecting power against sickness; and against an infection threatening life, which formerly used to destroy the population of whole nations, and to throw them back for centuries in cultivation and development, science brings a union of forces by which it is weakened or even destroyed. We may even regard the untutored strength of man, unguided by reason, as a crude and hostile work of nature, which frequently destroyed the fruits which had been developed by the civilizing industry of many centuries. Natural science has contributed in an extraordinary manner to trans-

form war into a scientific art, which can scarcely be brought to a high degree of perfection by any nation, if it has not in other respects attained a considerable degree of development. And thus this expression of power, which is at all times dangerous, might have lost, at least on one side, some of its horrors. In short, science facilitates, enlarges, and in various ways secures our condition in life, and removes various obstacles, which prevent the free activity of the spiritual development of mankind.

II.

*Methods of Universal Natural Philosophy.**

§ 10. All precepts which can be given for the investigation of nature must spring from the fundamental truth: That the whole of nature is the revelation of an infinite rational will, and that it is the task of science to recognize as much of it as is possible to finite powers.

From this great fundamental truth there proceeds a number of fundamental laws, which must hover before the eyes of the naturalist as eternal guiding stars. His chief task is: To seek for Reason in Nature. He must therefore admit that natural laws everywhere harmonize with reason, and that every appearance of an exception to this rule must proceed from the imperfection of his knowledge.

No contradiction is possible in the laws of Nature; on the contrary, they are all in the most perfect harmony, and constitute together one sole inextinguishable Whole. If we direct our attention to the cause of the changes, we see that everything proceeds with perfect consistence. If then we direct our attention to what has been effected, we shall be compelled to admire each human representation of surpassing wisdom. We can frequently perceive so distinctly the exact consequence of events, that they may become a principle of knowledge to us. The wisdom of the end in view is elevated

* By Natural Philosophy is here understood, the doctrine of the universal natural laws, that is, of the laws concerning the changes which may take place in all bodies; for instance, all bodies may be moved, all may be heated, and cause ether to oscillate.

so far above our capacity, that our reflections upon it may certainly lead to investigation, but can give us no foundation to build upon.

Natural laws are invariable as the will from which they originate.

The fundamental forces of nature are indestructible. By fundamental forces we understand the simplest and most original indications by which the creative power is recognized in external nature.

The same forces always act according to the same laws. Actions which are really alike must proceed from the same forces. In order to investigate the laws of forces, we must endeavour to recognize each particular force in its purity, its laws of action in its simplicity; but at the same time never forget that each force is only a part of the Infinite Whole, and only subsists so far as that exists.

We endeavour to comprehend Infinite Reason in Nature with our limited capacities, therefore we must constantly be distrustful of our own knowledge, and only confide in our representation of the thoughts of nature, in so far as they are clearly determined, and are in harmony with all which, according to our perfect conviction, is indisputably true.

We must compare the evidence of reason with experience: we must endeavour to change the evidence of experience into an evidence of reason.

§ 11. The basis of universal Natural Philosophy, both according to the idea which we have exhibited, as well as by the manner it has developed itself in the course of time, is Experience. Nature exhibits to us many of her changes so strongly and visibly, that we cannot avoid remarking them. These are the every-day experiences, which are not called so because most of them are of daily occurrence, but because they are perceived by no more than an every-day attention. Others we only discover by thought, while we turn our attention upon them. To gain knowledge from these in this manner is called to *observe*. Finally, there are many experiences which are not immediately exhibited to us by Nature in a very intelligible manner. In order to detect their essential character more narrowly, we must endeavour to bring the objects together so that their effects may be more comprehensible to us. In other words, in order to see as perfectly as possible the mode of operation in nature

we must understand how we can absolutely set them in action, and as it were compel them to act under our eyes. This is called to make experiments—to experimentalize. Nature obliges us to make daily experience; she invites us to make observations; we perform the experiment ourselves; it is a work of our most perfect freedom. It is easily perceived that these are all degrees of one and the same kind of knowledge, which are so intermingled that we can draw no defined limits between them. Each experience easily passes with every thinking man into a closer contemplation, which, without any perceptible gap, leads him on to actual observations.

From a mere arbitrary direction of attention to the point which at that time particularly constitutes the object of curiosity, he soon begins to compare, to distinguish, and to arrange the whole variety perceptible to the senses, which appears to be in connection. He endeavours to sharpen his senses by practice; he strives to measure their power, to prove them, and to determine them, and, where it is possible, to correct their mistakes. By habit he acquires a readiness to discover what is rare and peculiar in natural events, to find out their less remarkable similarities and differences, and exactly to distinguish what belongs to each individual part. Where this no longer suffices, he seeks by artificial means to facilitate his observations, to widen their circle, to make them more accurate. He measures magnitudes by arrangements invented for the purpose; he understands how to enlarge and to render more distinct those objects which were too small or too remote for the power of his senses; in short, by artificial and arbitrary means, he investigates more and more into nature, and is gradually changed into an experimentalist, who uses the same means as the ordinary observer, but adds new ones, and particularly distinguishes himself by greater freedom. Where nature operates with variously combined forces, he seeks to retain some of them, in order to allow the others to work more freely—even to retain all the others, in order to let one singly express itself with freedom. What nature accomplishes on a great scale he must often endeavour to represent on a smaller, in order to bring it nearer to the eye; and what nature presents on so small a scale that it would even elude the keenest sense, he must know how to render visible even to the less quick-sighted, for which purpose he has certainly far more

means than the casual observer. He must know how to bring what nature effects only for one sense before the judgment-seat of the others, in order that the more acute may clearly comprehend what the weaker only dimly perceived. Indeed, in order to view properly the nature of the thing, he places it frequently in perfectly new relations, never before offered by nature; so that his previous suppositions are either by that means strengthened or overthrown. ~~In short, he everywhere seeks to compel the most secret powers of nature to reveal themselves, and endeavours to determine their course by measure and weight. The elaboration of the whole riches of external knowledge constitutes the great connecting art of Experience, whose cultivation to a degree previously unknown, forms the peculiarity of modern Natural Science.~~

§ 12. ~~This art presupposes many spiritual and material natural endowments, and much dexterity acquired by long practice; yet all these qualities would be useless, if they were not guided by a mind familiar with nature. To have seen a great number of natural phenomena is not to have an insight into nature. Experience only becomes instructive to us by a correct combination. To observe is to detect the actions of nature; but we shall not advance far in this path, unless we have a notion of its character. To make experiments is to lay questions before nature; but he alone can do that beneficially who knows what he should ask. Through the whole art of experience it is therefore necessary that, upon one side, the inquirer should constantly retain the whole in his view—for otherwise it is impossible to have a clear representation of the parts; on the other side, that he should regard nothing as beneath his attention, for it still belongs to the whole. He should never forget that the forces by which life and motion are preserved throughout nature are found in the least and most insignificant as well as in the greatest and most remarkable objects. Then he will enter upon his work with the utmost earnestness and attention, reverentially acknowledging that it is the Eternal Source of nature who speaks to him, even in the most insignificant object. With this spirit and with this constant view of the whole, occupations which are frequently troublesome, and which enter into the smallest trifles, lose their insignificance to him; he elevates them to himself, and does not allow himself to be drawn down by them. He does~~

not content himself with a single one-sided experience. He seeks everywhere to combine it with others, to deduce the one from the other, and to arrange all in such a manner, that the whole course of observations or experiments represent one natural law. The same object is therefore exposed to the most different actions; the same action is tried, if not upon all bodies, which would be impossible, yet upon many of each division, and on the most remarkable, which chiefly differ from one another. We must besides search for the same effect as variously as possible in the observations, and produce them in the greatest variety of forms in the experiment (this is called, to vary the experiment), in order thence to be able to see, with so much the more distinctness and certainty, the conditions under which they occur. It is only by giving the observations and experiments which are made such a *connection, such an extension and variety*, that his labour can procure him knowledge, and become more than an imperfect account of an isolated phenomenon. If in one or more connected experiments he has seen a certain series of phenomena, which succeeded one another in a determined order, he begins his experiment from the opposite side, in order to see whether all follow in the reversed order, that is, the experiment must be made in both the *opposed directions* that are possible; it is said in chemistry, that a proof is only complete when it is both *analytical* and *synthetical*. If it is possible by observations to follow the same course, this must naturally happen. In this manner we are most certainly convinced that we have had the correct representation of the connection of natural events. Yet, with all this, we might be easily deceived if we allowed circumstances which were foreign to the purport of the inquiry to be mingled with it. When this happens, the observation on the experiment is different from what we expected, and with regard to this idea, we say that it is not *pure*. Therefore, in observation we must turn all possible attention to the surrounding circumstances. In experiments which refer to the nature of matter, we must only select it pure, free from extraneous matter, and where it depends on the form we must procure instruments whose perfection for the attainment of the given end most nearly approaches mathematical exactitude; but since we can seldom exhibit an object which perfectly harmonizes with the idea, we must endeavour to discover the devia-

tions, and bring their influence to bear; in chemistry we must, therefore, consider the nature and magnitude of the unavoidable impurities; we must also know and calculate upon the imperfections in the instruments of measurement, and thus everywhere penetrate to the idea through the senses. If to all this we still add a complete statement of all the observations, or the definitions, belonging to the experiment, so that when each alteration is noted down its magnitude is confirmed, and its connection with others and its mutual relation to outward circumstances is not lost sight of, the explanation is exact. Finally, the naturalist, in order to be certain that his senses have not deceived him, must frequently repeat his observations and experiments.

§ 13. In Natural Philosophy the experimental manner of proceeding is wholly dominant, on which account, as has been previously remarked, it is exclusively named *Experimental Natural Philosophy*. It first originated indeed in daily experience and observation, and still derives its most important nourishment from these, though they have almost vanished from its reports and representation. It belongs to the spirit of Natural Philosophy to turn each experience and each observation, as much as possible, into an experiment; indeed, it even endeavours thus to express the knowledge that has been gained by reflection. The friend of nature delights in observing her operations; he will be enabled frequently to recall them to his senses; he is anxious to know them as accurately as possible, and from all sides: he must therefore be master of the investigation. Thither must the experiment lead him. Yet everything does not depend on that alone. Experimental art will only then have attained its completion, when it enables us to represent all the laws of nature in a series of operations. Meanwhile, however much our art must remain below this ideal, still it is its ideal, to which it must aspire, if it is desirous to have a firm basis in itself, and not to be merely a collection of tricks. By this comprehensive experimental statement, Natural Philosophy acquires immediately a greater solidity; for the mere conclusions of reason alone, however profound they may be in themselves, yet presuppose that the representation, which we have formed of the object of inquiry, really agrees with them. Yet in this respect we easily deceive ourselves. In nature, so many circumstances operate at every point, that we may

easily overlook one or the other, and in consequence imagine a representation which does not perfectly correspond with the object. But if the experiment proceeds hand-in-hand with thought, an error is only possible by several mistakes encountering one another.

§ 14. We may, however, regard experimental art from a still higher power of view. It has moulded itself into a peculiar creative art (*Nachschaffungs-kunst*), not merely in order to behold the external world, or to discover its nature, but at the same time to transfer our souls into creative activity, so as by that means to produce a more harmonious, living, and powerful knowledge of the constant development of nature. Its peculiarity is the creative mode of proceeding (the genetic method), and it does not happen only when we are surrounded by material objects, but it is also perfectly at home in all which is alone exhibited to the inner sense. If we conceive a point which allows itself to be moved, in order to describe a line, or a line moving round one of its terminal points, in order with the other to describe a circle, what is that but an experimental idea? The differential and integral calculation consists entirely in such mental experiments and such contemplations. Where this mode of procedure takes place (and it does so much more frequently than we imagine), it is particularly calculated to satisfy the endeavours of a lively and powerful thirst for knowledge; for through other kinds of representation we generally learn more *why one must be convinced* that this or that is the case, *than why* it really is so. Here we see the origin of every truth. The origin of its existence and of our certainty therefore coincide, so that if it is represented in this manner, it is already proved. If it now belongs to the nature of natural philosophy, to let us follow the development of the ideas of the thing, it is evident that we must often take refuge in those experimental ideas which hitherto we have too much overlooked. Kant has given us, in his metaphysical rudiments of natural science, the most beautiful examples of this representation, yet without bringing forward the view introduced here.

§ 15. Mathematics take considerable part in the explanation of natural philosophy, but they belong also to the very nature of the thing. Each change, and likewise each portion of these changes, has indeed its magnitude. These

magnitudes, as well as the manner in which they result from one another, can only be determined by the aid of mathematics. The doctrine of motion is almost entirely changed into mathematics. The doctrine of forces* awaits the inventive spirit, which may lead it to the same point, for the inner forces are exhibited to us in time and space, and their laws can only then be considered as perfectly known, when we can represent all apparent relations in their true magnitude. Many of the most distinguished labourers in natural philosophy have too strenuously endeavoured to impress upon it the form of mathematics, or rather Euclid's geometry, whence it was regarded as an applied mathematics. By that means we deprive science of its natural form. The mathematician endeavours to deduce all his propositions from the smallest number of single fundamental truths; all other views are sacrificed to an artificial severity in the proof. Even in the applied parts of his science, where he must borrow certain fundamental experiences, next to clearness and precision, he seeks solely to be as independent as possible. The naturalist, on the other hand, especially endeavours to find the most direct connection between the operations of the various forces of nature. The experiences which the mathematician can only borrow, are to him a property. He does not, therefore, fear to use them abundantly as his proofs, if he can only represent them with the clear impression of their inward connection; therefore, he often deduces propositions direct from the nature of an action, which the mathematician discovers only by a circuitous route from some fundamental truth, on which the latter prefers to build. Applied mathematics and natural philosophy thus treat of the same subject, and have this also in common, that they wish to show us the reasonable connection between the same things; but the one will show it as it were by compulsion, and is satisfied with an artificial connection when it can find no natural one; the other, on the contrary, will see the thing in its most natural,

* In the first edition of this paragraph, and also previously, I have entitled the doctrine of forces, all those portions of physics which are not the simple doctrine of motion; and the same with the doctrine of the laws of chemical combinations and separations, the doctrine of electricity, magnetism, and the action of heat and light. However much all these operations point to inward movements, I have not hitherto been willing to change the name of Doctrine of Forces.

or we may rather say in its immediate connection with reason, and is contented with no other. We may, therefore, indeed assert, that both must encounter one another at a certain degree of perfection. Mathematics and natural philosophy must everywhere approach an inward union. The former represents the natural laws for magnitudes, the latter the laws for objects which have magnitude, and which coincide with it in every operation. The one has, therefore, at all times contributed to the development of the other. If the former has presented to the latter somewhat of its certainty and its power of invention, the latter has again presented the former many new and essentially constituent parts, and will certainly add still more by the development of the doctrine of forces. We have brought natural philosophy sufficiently near, perhaps too near, to mathematics: it is probably time that mathematics should endeavour to approach natural philosophy. Geometry in its present form will always be one of the most splendid monuments of the human mind, and will serve to exercise and sharpen the understanding by its inward perfection; but may not another mode of explanation be able to subsist along with it, in which all geometrical propositions may be represented by a series of experimental ideas? We should by that means open for mathematics a far brighter and more immediate insight into the actual source of each truth, and a much closer amalgamation between it and natural philosophy would thus be gained than formerly existed. The progress of natural philosophy will, on its side, forward this amalgamation; for the farther it advances the more it will succeed to refer all operations to individual forces, whose power and condition, in time and space, will constitute its essential object. By that means our science must change itself into a mathematics of nature, which certainly, both in form as in contents, will far surpass what has hitherto existed.*

§ 16. When we discover the universal natural law which a phenomenon obeys, or when we refer a more limited natural

* I had already attempted a representation of geometry, as above described (namely, after the genetic method), before the publication of this programme. I can no longer hope to accomplish this work. One of my former pupils, Mr. Rector Siemesen, in Helsingør, has adopted the idea, but has treated it independently, according to his own views. There are also some far earlier attempts of this kind. Besides all this, there is yet more to be accomplished.

law to a more universal one, we say it is explained. It may be thought that we comprehend a less distributed operation under one more widely distributed, and in this manner the explanation of the operation is viewed as the testimony of its cause. When we do not clearly see what natural law is obeyed by an operation, or by a union of operations, we endeavour to obviate this want by a presupposition. We have bestowed on these presuppositions the name of hypotheses. We must view them really as an experimental idea, by which we can discover whether anything can be explained by a certain presupposition, included with the remaining laws of nature. If we find that everything in a rich and many-sided experience, may be understood by presuppositions, we admit it to be true. If, on the other hand, we find a circumstance opposed to the presupposition, it is rejected; we then seek for a new one, which is perhaps again overthrown by a similar trial; and so on till we meet with one which is not destroyed by the trial. When an hypothesis is not indeed refuted by experience, but yet does not explain everything that it should explain, we regard it as more or less probable, in proportion to the completeness of the explanation. The task of investigation has not therefore been entirely solved, which tends to destroy conjecture as conjecture, either by a perfect confirmation or by a perfect contradiction; but it remains as a question proposed upon a principle; and so regarded, it remains as a conjecture to be proved, or as a probable supposition, which we endeavour to place in connection with the rest of philosophy. Every conjecture may really be regarded at once from both sides, but in general there is a preponderance on one side, so that either there is a strong demand for further investigations, or the probability must be taken almost solely into consideration, because the present condition of the thing permits no further inquiry. The former appear as active, living elements, in the development of science; the latter, on the contrary, often hinder its progress, since they take such root with those who are controlled by habit, that they are defended as if they were confirmed truths.

§ 17. The complete confirmation of an hypothesis or its transition to a state of certainty, requires that all the consequences which are deduced from the admitted presupposition should really coincide in experience. If we could have

deduced from it all possible results, and found them all confirmed, then the hypothesis would be changed into certainty; for it is impossible that two different causes can produce effects which are in every respect similar. But since our knowledge and experiences are limited, we must be content to go as far in this respect as our powers will permit. First, the hypothesis must be expressed with the utmost simplicity and clearness. This circumstance is of the greatest importance, and its neglect has caused incalculable confusion. We must then deduce from the assumed presupposition as many direct results as we can derive. If experience contradicts some of them in such a way that we cannot hope to solve the difficulty, the fate of the hypothesis is thus also at the same time settled. On the other hand, if the results deduced harmonize with the experiences which have been compared, we must further prove whether the results of continued conclusions also harmonize with the reality, and whether this is also the case in combined relative conditions. If this be the case, and in such a manner that not only every part of the operations which have been investigated take place, but that they also take place in the same order, and exhibit themselves in that degree of magnitude in which they ought to exhibit themselves according to the results which have been deduced from the presuppositions, and if they at length fail, when by the same results they should fail, probability has passed into certainty; for in order that all this should take place, ~~innumerable circumstances must really coincide, although but small portions of them attract our notice,~~ and thence the probability is infinite, that is, certainty. In this coincidence of ideas with experience, the harmony of the magnitudes which are calculated upon with the real magnitudes is of immense importance, and is almost alone sufficient for confirmation; because in an infinite number of possible cases, exactly the one given harmonizes with the calculation. We could in this manner confirm even a presupposed cause, or a probable natural law, which has never come forward in experience. But in such a case there must be the most perfect and many-sided coincidence between conclusions and experiences, and here, perhaps, we should never satisfy the just demands of science. For the sake of trial, such an hypothesis may be permitted, since it may lead to the discovery of what was hitherto unknown, although it must always be regarded as easily leading

to what is false ; but if assumed as a probable supposition in science, by which it becomes more closely connected with the other elements of science, it is objectionable. Therefore an hypothesis which is permitted in the system of science ought only to relate to the connection between a cause or a universal law of nature, of whose existence we are certain, and whose action or more limited natural law we would from it explain. Finally, we must especially avoid mingling hypotheses with the declared truths of science. In this respect we must distinguish between the connection and the union of many phenomena which are always expressed by hypotheses, and the opinion on the unknown causes of effects, which with them will equally force themselves on our notice. If we can but perceive this clearly, and, rejecting the latter, hold fast alone to the former, we shall seldom be losers.

FINIS.







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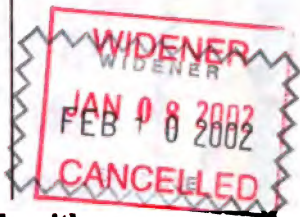
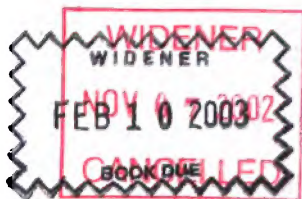
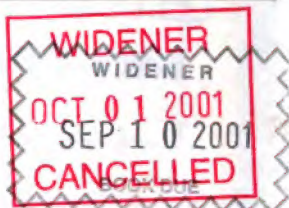
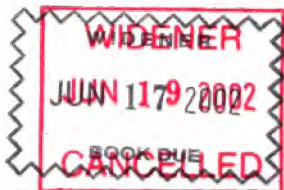


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